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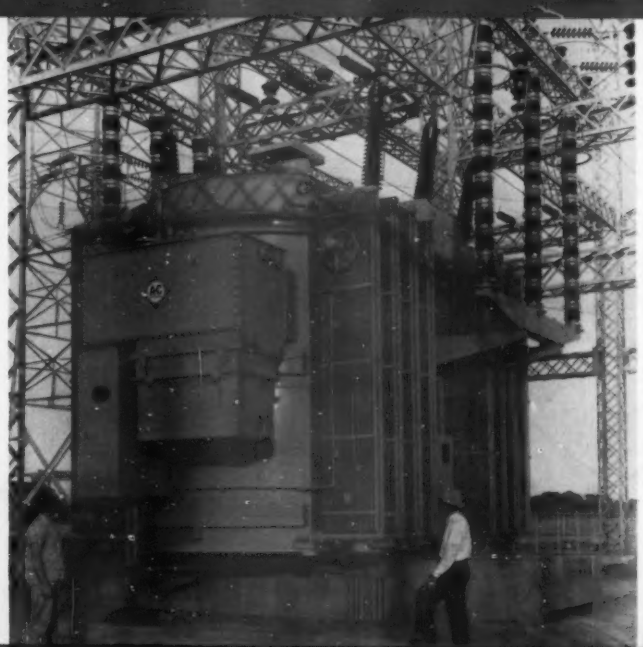
Another article in the series on the National Electrical Code—Pg. 40

FEBRUARY 1958

The problem of setting poles in difficult terrain has been solved by one Western utility. A specially equipped helicopter dropped the poles into prepared holes at the rate of one every three minutes—Pg. 57



Economic advantages of autotransformers are resulting in wider application. The unit shown here was recently put to use by Houston Lighting and Power Company for system inter-connection—Pg. 54

- Transistorized converter for fluorescent lamp power—Pg. 26
- Combating contamination on high tension lines—Pg. 48

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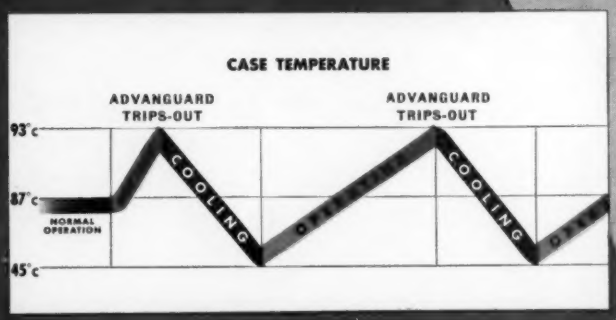

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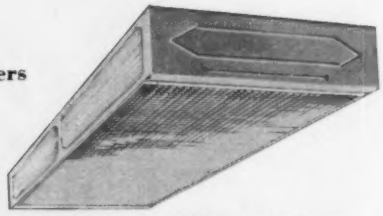

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Economic comment

by J. Whitney Bunting, Ph.D.

Contributing Economics Editor

Budget time again

President Eisenhower's latest budget is one that will be reviewed most critically in the days immediately ahead. Not that all budgets do not receive critical appraisal — they do. Rather, this present budget will receive analysis as to its completeness for the tasks that lie ahead.

In other words, many congressional leaders fear that the nation may not have proper funds set aside for the defense of the country, and they shall review such items with a pressure for an upward appropriation. Generally, budget appraisals tend to move the suggested appropriations in a downward direction. This year the trend on the whole may be upward.

The critical events that have occasioned this type of consideration by Congress can be listed as follows:

1. The early and successful challenge offered by Russia to the free world in the Sputnik I and II firings.

2. The increasing knowledge that American education may be lacking in providing the sort of manpower needed for the national well-being, in all its facets.

3. The fears that have accompanied rather incomplete statements issued about both the Gaither and Rockefeller reports, both indicating, at least, a growing loss of leadership over Russia in the military area.

4. The weakening into recession conditions of certain segments of the national economic scene in spite of most claims by industrial, business and government leaders that the situation is not out of hand but is temporary in nature.

5. The fact that 1958 is an election year when political fortune can be made or lost by many Washington representatives of both parties.

Any one of these items would have been sufficient to make a review of a presidential budget an unusual one. Coupled together, they leave little alternative but to agree to the basic costs represented or even to provide increased appropriations in certain areas.

Needless to say, there will be little positive talk about a tax cut this session for most people are in essential agreement that a program of real merit to meet today's challenge will require considerable financial outlay and thus all possible revenue sources must be maintained.

The missile program

To illustrate just how unusual this particular year may be in budget making, one has only to refer to the past year when the Defense Department was hard-pressed to hold even a reduced budget. Many very honest lawmakers felt that the military and defense expenditures were overemphasized in relation to other needs.

This year the reverse is true. Certainly the Russian satellite program and its success (in contrast to the disastrous United States efforts) has done much to spark the urge to increase defense spending. Yet the entire armament race has now become so centered in the public mind that appropriations for all types of military effort may be far more easy to come by.

Along this same line is the most welcome news that the Cordiner report suggesting pay increases in the services for needed skills and abilities may soon be implemented into action. The Administration held back on this proposal as too costly only a short year ago. Now that the missile program needs to retain the well-trained scientific personnel in the armed forces, the Cordiner report has been reported out for favorable action.

This proposal, in the long run, will reduce personnel costs in all branches of the service. Instead of repeated separations from military duty at the end of enlistment periods (and the high costs of training new personnel), many men will stay on as career technicians. Thus, a needed backlog of technical manpower will be available for military missile development. Only the conditions apparent this year could have forced this favorable action.

Education and the age of science

Last year a rather elaborate program of aid to education was developed with a view toward ending the shortage of faculty and facilities in this important area. However, the strength of the Administration as well as the supporters of education generally could not provide the impetus to get such legislation passed.

This year, however, there is a widespread pressure to provide more adequate support for education, particularly in the areas of science and engineering. Again, the public feeling in the competition with Soviet Russia has provided the basic challenge and there is little doubt but that an aid to education bill will be passed.

The measure being presently contemplated calls for a federal expenditure of $287,000,000. Already there are many pressure groups that proclaim that this measure is too small to accomplish the basic purpose of equalizing our science training with that of Russia. One can expect action that will accept as a minimum the federal recommendations for aid in this educational area.

Thus, 1958 is faced as a year with a huge peacetime budget. This situation will have ramifications of importance to business and industry in that tax relief is not possible now. However, government spending should result in a short-lived recession and a consequent improvement in business strength.

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

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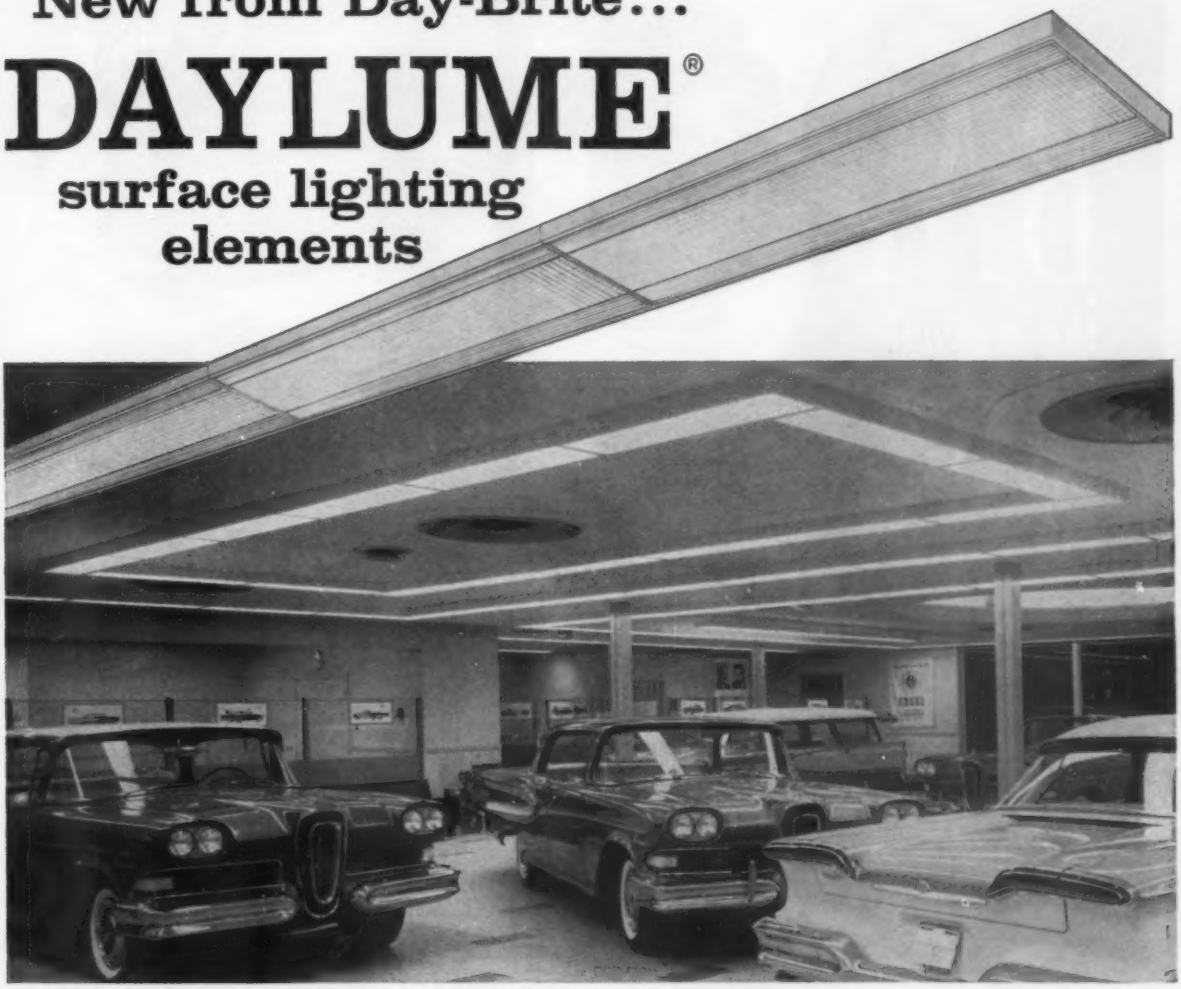

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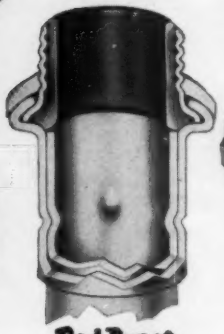

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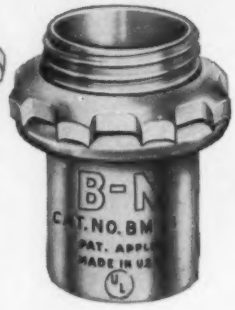

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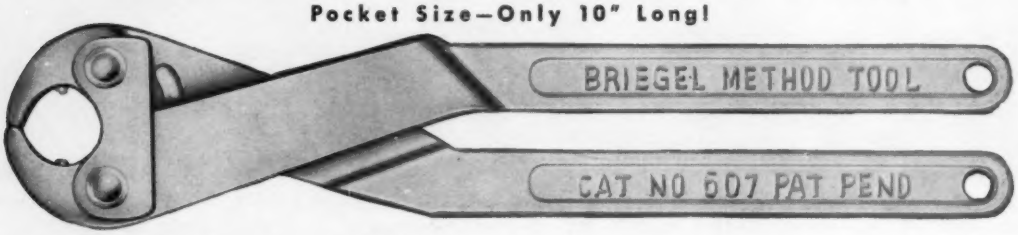

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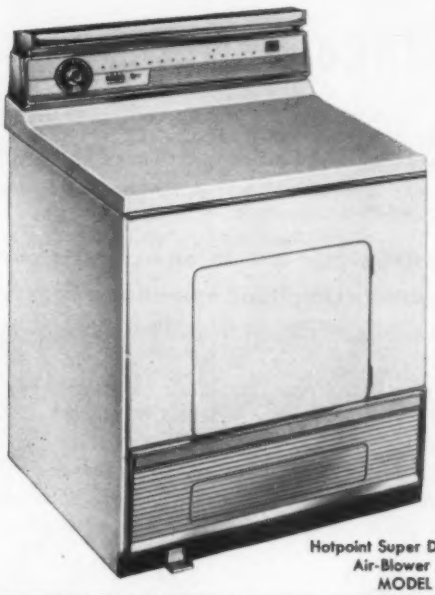

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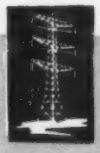

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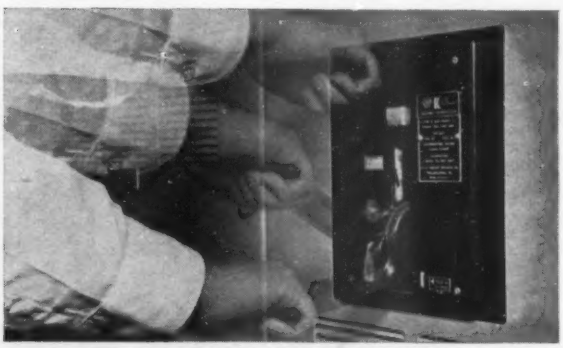
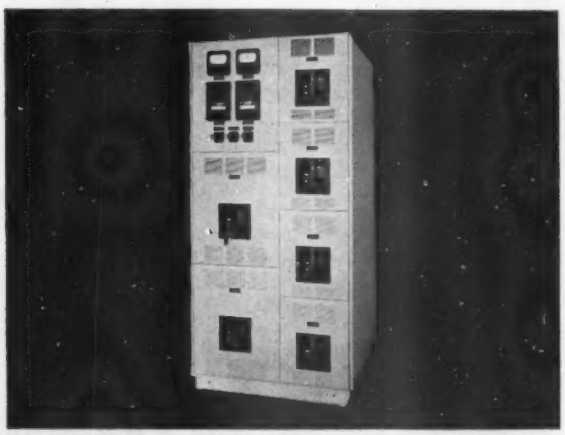
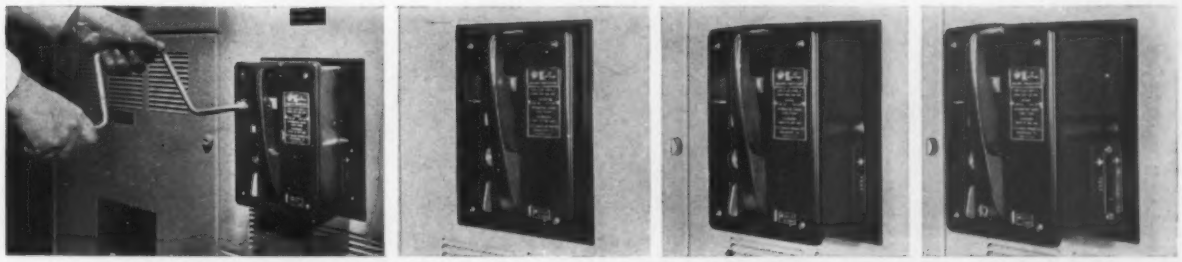


First quick-make manually charged stored energy closing mechanism. First 90% of pulldown handle travel charges spring mechanism, last 10% releases stored energy, automatically closes contacts. No teasing of contacts is possible.



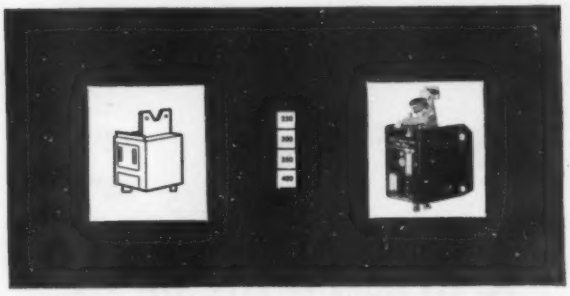
4-high stacking of 600 amp frame size circuit breakers in 90-in.-high enclosures. The new circuit breakers are as much as one-third smaller and 55% lighter than comparable units. The new switchgear is the smallest ever designed.



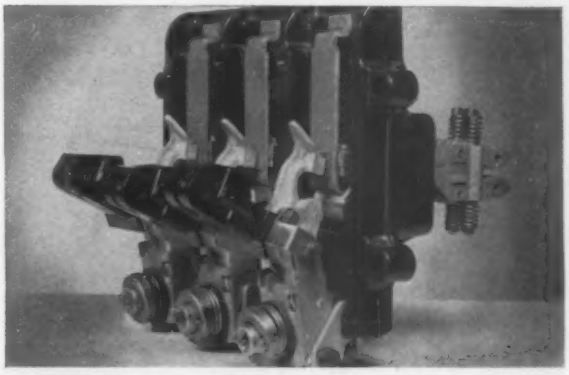
First closed-door drawout of circuit breakers. This permits racking of circuit breaker into connected, test and disconnected positions without opening the door of the circuit breaker compartment. Drawout arrangement keeps circuit breakers clean, aisles uncluttered, promotes personnel safety. Breaker must be opened before shutter can be lifted to insert drawout racking crank. Breaker cannot be closed while shutter is lifted.

Greatly increased accessibility to component parts for operation and servicing. For example, trips on electrically and manually operated breakers are out in the open and can be easily adjusted. Trips also can be changed quickly. One-piece molding holds trip units, which are changed from the rear and in a fraction of the time formerly required.

Stored energy electrical closure that materially cuts control circuit requirements. The motor-driven stored energy system requires only 10 amp from a simple power source, compared to as much as 160 by comparable solenoids. Quick-make manual closure operates on same principle. First 90% of pull-down handle travel charges a spring mechanism. Last 10% releases the stored energy and closes the contacts. No teasing.



Expanded trip flexibility meets last-minute load changes in many instances with the existing trip unit.



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Hand-and-hammer operated for strong, secure "nailing" to steel or concrete. Eliminates tedious drilling, boring. Does a better job, faster, with quality OMARK drivepins. Light weight. Low cost. Any builder can use it, make big savings.

For on-the-job counseling and service, see your factory-trained OMARK dealer. You'll find his name under "Tools" in the phone book yellow pages.

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OMARK Industries, Inc.
9701 S. E. McLOUGHLIN BLVD.
PORTLAND 22, OREGON

Costs GO DOWN . . . Installation Time DROPS . . . with BAR-BROOK* BREEZEBUILDER* ATTIC TYPE FANS

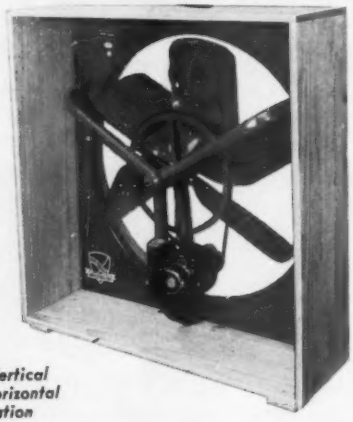
Built-in Shutter, Automatic or Manual

3 Sizes, for Ceiling Openings of 31", 36", and 42"

For Horizontal Operation

The BAR-BROOK AVP is a TRUE Package Unit.

Installation time is measured in *minutes*. Fan, shutter, suction box, precut ceiling trim are all one unit. Fan is already wired to motor and safety fuse link. Contractors say it's the easiest fan on the market to install. UL Approved, Certified Ratings.



Six Sizes:
30"
33"
36"
42"
48"
54"

For Vertical or Horizontal Operation

The BAR-BROOK FH ATTIC TYPE FAN

. . . will fit any installation. Quiet, efficient operation. Rubber-cushioned motor mount. Sealed ball bearings. UL Approved, Certified Ratings.

WRITE FOR CATALOG
of entire BAR-BROOK line of large fans and shutters.

BAR-BROOK MFG. CO., INC.
6135 Linwood Ave. Shreveport, La.

Certified Ratings AMCA

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*T.M. Reg. U. S. Pat. Off.

Today, substations are demanding aluminum bus and connectors for greater economy. For 30 years Anderson Electric has pioneered research with aluminum. Our production is complete from ingot to finished product. Our quality control methods insure "high density" by eliminating "pin-hole gas porosity" in aluminum castings. Anderson, and only Anderson produces a complete line of substation connectors — for every job — in aluminum.

For full information and details about specific connectors, contact your nearest Anderson representative or write

ANDERSON ELECTRIC

ANDERSON ELECTRIC CORPORATION
Birmingham 1, Alabama.

Export Representative: International Standard Electric Corp.

Aluminum & Bronze Power Connectors • Clamps • Fittings • Accessories for SUBSTATION • TRANSMISSION • DISTRIBUTION

CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

1086—Cable Connectors

Tomic Sales and Engineering Co., 20000 Sherwood Ave., Detroit 34, Mich., now have available catalog sheets containing data on the complete line of their connectors, couplings, and cable connectors.

1088—Fittings and Fixtures

A 32-page illustrated catalog covering Killark fittings and fixtures is offered by Killark Electric Mfg. Co., Vandeventer and Easton Aves., St. Louis 13, Mo.

1092—Electrical Boxes

Steel City Electric Co., 1207 Columbus Ave., Pittsburgh 33, Pa., offers a catalog of their complete line.

1136—Space Heating Guide

Cavalier Corp., Chattanooga 2, Tenn., has prepared a Guide for Calculations on Electric Space Heating. It is based on study of several thousand installations of electric heat and is a handy reference for calculating electric heating requirements and estimating operating costs. The booklet contains discussion, charts, and floor plan examples.

1166—Electrical Fittings

A 40-page illustrated catalog and price list on the Gedney line. Shown and listed are conduit, threaded entrance, SEC, EMT and ground fittings, and box connectors for both armored and non-metallic cables. Copies are available from Gedney Electric Co., RKO Bldg., Radio City, New York 20, N. Y.

1190—Electrical Fittings

Blackhawk Industries, Dubuque, Iowa, offers a complete catalog of electrical conduit and cable fittings. Also a special publication giving detail drawings and instructions for installing service entrance masts on low or ranch type buildings.

1192—Wire Pulling Lubricant

Illustrated six-page folder showing the advantages of an improved Y-Er Eas wire pulling lubricant is available from Electro Compound Co., 4145 W. 150th St., Cleveland 11, Ohio.

1214—General Catalog

General catalog of Royal Electric Corporation, Pawtucket, R. I. covering flexible, service and lamp cords, cord sets, extensions, trouble lights, wiring devices and fuses is available to wholesalers. Dealer catalogs may be secured from Royal distributors.

1218—Carbon Products

A 28-page catalog on Motor and Generator Brushes and carbon products telling how to order brushes, grade recommendations, characteristics, and description of brush grades, is available from the Helwig Co., 2536 North 30th St., Milwaukee, Wis.

1224—Electrical Equipment

The Wadsworth Electric Mfg. Co., Inc., Covington, Ky., has issued a new catalog Con 15-0 and Bulletin W. C. B. 53-1, containing data on their lines of Safety Switches, Service Equipment, Distribution Panels and "E-Z-RED" Circuit Breakers.

1230—Compression Connectors

An illustrated 18-page bulletin (13A) describes Squeezon compression connectors for all overhead distribution connections from line wire to ground rod. Offered by James R. Kearney Corp., 4236 Clayton Ave., St. Louis 10, Mo., the bulletin also describes the mechanical and hydraulic installation tools required and tells where to use each.

1238—Selecting Fuses

A 12-page descriptive handbook "Fuseology" tells how to get safest most dependable, trouble-free electrical protection from fuses. Contains useful information on selecting right size and type of fuses—how to stop needless blows—avoiding poor contact and other troubles. Issued by Bussmann Mfg. Co., University at Jefferson, St. Louis 7, Mo.

1240—Lighting Fixtures

Prescolite Manufacturing Corp., 2229 Fourth St., Berkeley 10, Calif., now has available a 20 page color catalog, No. 31-F, describing their complete line of lighting fixtures including recessed series and accessories, surface series and accessories, exit light, and aisle lights. A typical installation and dimensional drawing are shown for each fixture.

ELECTRICAL SOUTH
806 Peachtree St., NE
Atlanta 8, Ga.

February, 1958

Gentlemen:

Please send me the bulletins and catalogs indicated.
(Print Plainly)

name ..... Title .....

Company .....

Address .....

City & State .....

Circle numbers below. Bulletins and catalogs will be mailed promptly.

1086	1088	1092	1136	1166
1190	1192	1214	1218	1224
1230	1238	1240	1244	1248
1250	1254	1262	1266	1268
1298	1300	1302	1306	1308
1310	1312	1314	1316	1318
1320				

BE MODERN...GET THE Slim Trim LOOK OF POWER RANGE HOODS BY FASCO

Here's the power range hood with crisp, new styling that blends with today's trend to modern, efficient kitchens. And only Fasco has it!

Featuring built-in light, easy-to-clean filter, and quiet, powerful turbo-impeller, this new Fasco power range hood is the perfect finishing touch for any kitchen.

Give the kitchen you build the extra sparkle that lifts it out of the ordinary... install a Fasco power range hood and see how it pays off in sales.

BE MODERN...TAKE A fresh LOOK AT VENTILATORS BY FASCO

You will find it pays in more ways than one to take another look at Fasco. You'll see a complete line of ventilators all with smart "no-rust" anodized aluminum grilles. You'll see ventilators that cut installation costs ... the trimmest ventilator on the market ... and a host of other features in this value-packed line designed and priced to reduce your costs.

Take a fresh look at all the new Fasco features... they will convince you Fasco ventilators are your best buy today.

Please send me full information on new hoods and ventilators.
ES-258

Name_____

Address_____

City_____ Zone____ State_____

FASCO INDUSTRIES, INC.
ROCHESTER 3, N. Y.

FANNER ARMOR RODS

with the

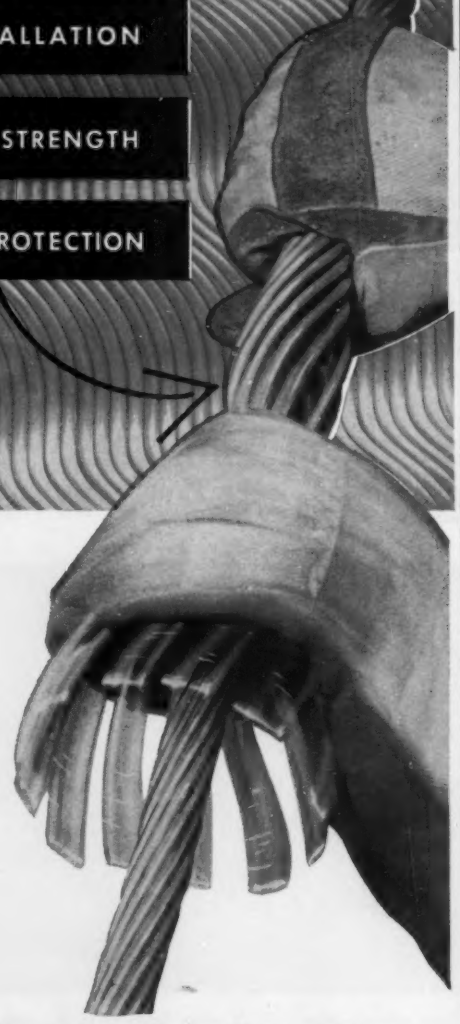
Superformed Spiral

provide

EASIER FIELD INSTALLATION

GREATER GRIPPING STRENGTH

LONGER-LASTING PROTECTION



• EASIER FIELD INSTALLATION

"*Superforming*" of special spring-type wire at factory into uniform spirals that snap perfectly into place by hand without the use of tools . . . eliminates costly, haphazard field fabrication of armoring.

• GREATER GRIPPING STRENGTH

The "close-pitch" spiral of "*Superformed*" Armor Rods winds around conductor developing a permanent non-slip full length grip that is stronger and tighter than made by any other method of armoring.

• LONGER-LASTING PROTECTION

"*Superformed*" Armor Rods reduce conductor strain...prevent conductor pitting and wear . . . eliminate hazards of end clamps.

To get the best — specify Fanner "*Superformed*" Armor Rods. Get acquainted with the important savings they offer by writing for descriptive literature today.

CENTER-MARKED, COLOR CODED AND PACKED IN CONVENIENT CARTONS

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PLASTIC FANNGUARDS · PLASTIC INSULATING TUBINGS AND MOLDINGS

Enter Code Numbers of Catalogs Desired on Coupon on Page 12

1244—New Electrical Fittings Catalog

Concise 36-page catalog illustrates and describes a complete line of electrical fittings, cable racks and wiring specialties. The catalog contains many detail drawings, clear-cut photographic illustrations of mast fittings, cable connectors, straps, hangers and ground clamps in a wide variety of types and sizes. For your free copy, write The M. & W. Electric Mfg. Co., East Palestine, Ohio.

1248—Conductor Armor

A new catalog of Superformed Armor Rods, Lineguards, Patch Rods, and Tap Armor describing various uses and applications of these products on overhead conductors is offered by The Fanner Manufacturing Company, Brookside Park, Cleveland 9, Ohio.

1250—Electrical Enclosures

Catalog No. 5354 currently being offered to the trade by B & C Metal Stamping Co., 590 Means St., N. W., Atlanta, Ga., is a well-organized, 94-page manual giving complete descriptive information, prices, and specifications on all items in the B & C line of electrical enclosures. Copies are available free of charge to electrical contractors.

1254—Construction Anchors

"Anchoring for Power and Communication Lines," a completely illustrated manual on improving line construction with better anchoring, has been published by the Advertising Dept., the A. B. Chance Co., Centralia, Mo. The 25-page booklet shows how to install the right anchor at the right place in the right way.

1262—Fluorescent Fixtures

The new loose-leaf catalog recently issued by Southern Lighting Manufacturing Co., 501 Elwell St., Orlando, Fla., contains complete diagrams, specifications, and descriptions for all fluorescent fixtures which they manufacture. In addition to the information on commercial, industrial and school fixtures, the catalog also lists hangers, troffers, troffer accessories, and incandescents which are available from the firm.

1266—Metal-Clad Switchgear

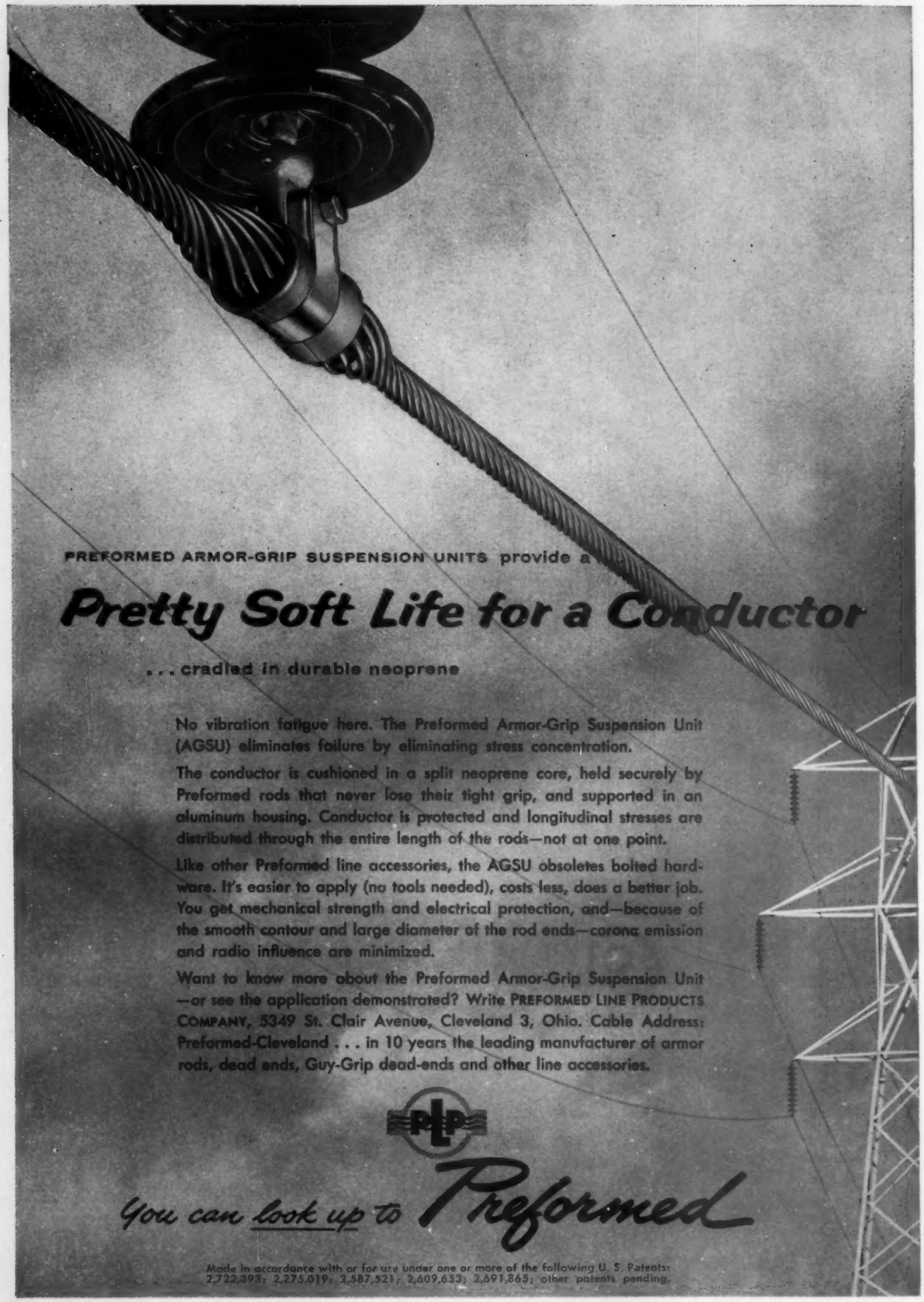
Detailed information on metal-clad switchgear is now available in two special bulletins, 700-B and 7004-C. These booklets give descriptions, application data and specifications on units up to 15 kv and 500,000 kva interrupting capacity. Wire I-T-E Circuit Breaker Co., 19th and Hamilton St., Philadelphia 30, Pa.

NO MORE WASTE when you cut a length of new SLIPKNOT #7 PLASTIC ELECTRICAL TAPE . . . and no more struggling to cut it, either. Because Slipknot's newly developed all-plastic tape cutter (pat. pending) rides the roll, and gives a quick clean cut when and where you want it. No more stretching and thinning the next several inches. Try new SLIPKNOT #7 with ZF-90 — Plymouth's formula for total adhesion — on your next job. You'll like it, and you'll appreciate the cutter, packed free* in every 66-foot can.

*Limited time offer

PLYMOUTH RUBBER COMPANY, INC.

DIVISION 13 — Makers of SLIPKNOT FRICTION TAPE — CANTON, MASSACHUSETTS


PREFORMED ARMOR-GRIP SUSPENSION UNITS provide a
Pretty Soft Life for a Conductor
. . . cradled in durable neoprene
No vibration fatigue here. The Preformed Armor-Grip Suspension Unit (AGSU) eliminates failure by eliminating stress concentration.
The conductor is cushioned in a split neoprene core, held securely by Preformed rods that never lose their tight grip, and supported in an aluminum housing. Conductor is protected and longitudinal stresses are distributed through the entire length of the rods—not at one point.
Like other Preformed line accessories, the AGSU obsoletes bolted hardware. It's easier to apply (no tools needed), costs less, does a better job. You get mechanical strength and electrical protection, and—because of the smooth contour and large diameter of the rod ends—corona emission and radio influence are minimized.
Want to know more about the Preformed Armor-Grip Suspension Unit —or see the application demonstrated? Write PREFORMED LINE PRODUCTS COMPANY, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland . . . in 10 years the leading manufacturer of armor rods, dead ends, Guy-Grip dead-ends and other line accessories.
PLP
You can look up to Preformed
Made in accordance with or for use under one or more of the following U. S. Patents: 2,722,393; 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.

Enter Code Numbers of Catalogs Desired on Coupon on Page 12

1268—Lighting Fixtures
The Perfeclite Co., 1457 East 40th Street, Cleveland 3, Ohio, makes available the following literature: (1) Data Folder 54-B—4 pages of engineering information, prices and specifications on Plastic Indirect Concentric Ring Luminaires. (2) Data Folder EX-55-A—10 pages of information on Exit Units for all building locations. Complete engineering data and prices given. (3) Data Folder 56-A—information on Ceiling Pan Fixtures and Vapor Proof Prismatic Exterior Fixtures.

1298—Electrical Fittings
The Electrical Fittings Corp. of Woodside, New York (EFCOR) offers a complete catalog covering all types of fittings for all types of raceways and conductors. The catalog also features an extremely comprehensive "What Goes Into What" section covering 5 pages alone.

1300—Lighting Control Switch
The Arrow-Hart and Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn., offers a one page information sheet on their new quiet, tap action, lighting control switch, designed to fit any standard toggle wall plate.

1302—F. Lamp Maintenance
An informative folder on Fluorescent Lamp Trouble Shooting is offered by Champion Lamp Works, Lynn, Mass. It features an illustrated trouble shooting check chart. The Champion Lamp Works also has available a helpful slide rule on lamp application, covering incandescent, regular fluorescent, and slimline lamps.

1306—Fasco Fans
Fasco Industries, Inc., North Union and Augusta Sts., Rochester 2, N. Y., offers a thirty page catalog describing their line of window fans, oscillating fans, hassock fans, kitchen ventilating fans, and range hoods.

1308—Cable Spinners
A complete data file on aerial cable spinners and tools is available from Cable Spinning Equipment Co., 3100 Topeka Blvd., Topeka, Kansas. The file includes reprints of pertinent articles, operating instruction book, and price list.

"The Ripley people know the street lighting control business. They pioneered the first control way back in 1936. Over the years they have demonstrated proof time and time again of their leadership in this field. When Ripley Company puts a new control idea on my desk, I know it's already had its trials. Their engineering staff has tested its merits; their research division has given it the most rigorous scientific tests; their production department has studied it. So I know it's right! We know they keep ahead in control developments; and in research. They go the limit to give service to customers. And with their factory set-up we're always sure to get the deliveries we need."

Learn why "THE SWITCH IS TO SUNSWITCH" — Write for Bulletin 5900-A

Over 20 Years of Experience & Know-how in Street Lighting Controls!

RIPLEY ESTABLISHED 1926

SunSwitch DIVISION

RIPLEY COMPANY, INC., MIDDLETOWN, CONN.

Standard-threaded rigid steel conduit is the **only** wiring system approved today by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies.

YOUNGSTOWN "BUCKEYE" CONDUIT

. . . gives life-time wiring protection to Zanesville's Good Samaritan Hospital

Good Samaritan Hospital
Zanesville, Ohio

Architects: Dan A. Carmichael, Columbus, Ohio
General Contractors: Knowlton Construction Company, Bellefontaine, Ohio
Electrical Contractors: Electrical Contractors, Inc., Columbus, Ohio

Failure of its all-important electrical system will never interrupt the smooth operation of the Good Samaritan Hospital in Zanesville, Ohio. That's because the builder of this well known institution wisely specified Youngstown's Full Weight Rigid Steel "Buckeye" Conduit for protection of the wiring system from damaging elements such as water, moisture, vapor, dust and dirt.

If the proper functioning of **your** electrical wiring systems—in any location, under any condition—presents a problem, then Youngstown "Buckeye" Conduit should be your specification. Reports from across-the-nation tell us, "It's easier to bend and thread, wire fishing is faster and easier—and its superior corrosion-resistance gives a much longer service life after installation"

Remember, Youngstown is the only producer of rigid steel conduit that controls all its integrated operations from ore mine to finish threading. Thus, you can be sure each length is of the same high quality that has made "Buckeye" Conduit the accepted standard of leading owners, architects and contractors everywhere.

Delivery is no problem—because all leading industrial and electrical distributors carry complete and ample stocks. Why not call today for quick and efficient handling of your current requirements.

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
District Sales Offices in Principal Cities

Enter Code Numbers of Catalogs Desired on Coupon on Page 12

1310—Vinyl Plastic Tapes

Three booklets just issued describe Dutch Brand vinyl plastic tapes available for a variety of applications. Plastic tapes in colors, pressure sensitive strapping tape, and Trantex Tape designed especially for protection against corrosion are among those manufactured by Dutch Brand Division, Johns-Manville, 7800 So. Woodlawn Ave., Chicago 19, Ill.

1312—Killark Fittings

A new catalog section covers Killark plugs and receptacles in two basic designs: explosion-proof and weatherproof. This new line offers many advantageous features, and is available in many styles and sizes to fit various boxes. Killark Electric Mfg. Co., Easton and Vandeventer Ave., St. Louis, Mo.

1314—Wiring Equipment

Keystone Manufacturing Co., 23328 Sherwood Road, Center Line, Mich., has issued a new catalog (158 March 1, 1958) giving complete specifications and illustrations on their line of wiring installation equipment. Included in the 70-page catalog are wireways and auxiliary fittings, cutout boxes, outlet boxes, switch boxes, and cabinets, giving Code requirements, and price sheets.

1316—Electric Heating

Electromode Division of Commercial Controls Corp., 570 Culver Rd., Rochester 3, N. Y., is now offering their new catalog EC-199 describing a complete line of electric heaters and heating systems for the home. Descriptions, specifications and illustrations are included for wall and portable heaters for large and small rooms, radiant panel heaters, baseboard heaters and radiant cable heat.

1318—Power Bender

The lightweight hydraulic power bender #884, manufactured by Greenlee Tool Co., of Rockford, Ill., is described in a new bulletin issued by the company.

1320—Bending Equipment

A concise eight-page brochure has been made available from Tal Bending Equipment, Inc., 417 N. Water St., Milwaukee 2, Wis., describing their "One Shot" bender line. The Tal bender uses the same frame for standard pipe, copper tubing, radiant heat coils, rigid and thinwall conduit, bus bar, flat, round or square stock—from ⅜ to eight inches.

Speedolets save dollars and hours on every installation! No threads or special clamps are needed. Slip into place, tighten set screws. They cost less than other type fittings — and save labor cost on installation.

Short on installation time, but long on durability! Speedolets are die cast of the same special aluminum alloy that has made Killark fittings famous for years. They'll last and last . . . because aluminum never rusts or corrodes.

the "Man on the Ladder" selects...

KILLARK SPEEDOLET FITTINGS

For Thin-Wall Conduit

"I'm sold on KILLARK'S new line of Speedolets . . . they make the fastest, neatest installations I've ever seen."

"Now I can go up the ladder with no more than a screwdriver in my hands. All I have to do is slip the fitting over the thinwall conduit, tighten a set screw — the job's finished! No wrench to use, no small parts to handle.

See Your Killark Representative:

ELECTROLET KILLARK SPEEDOLET

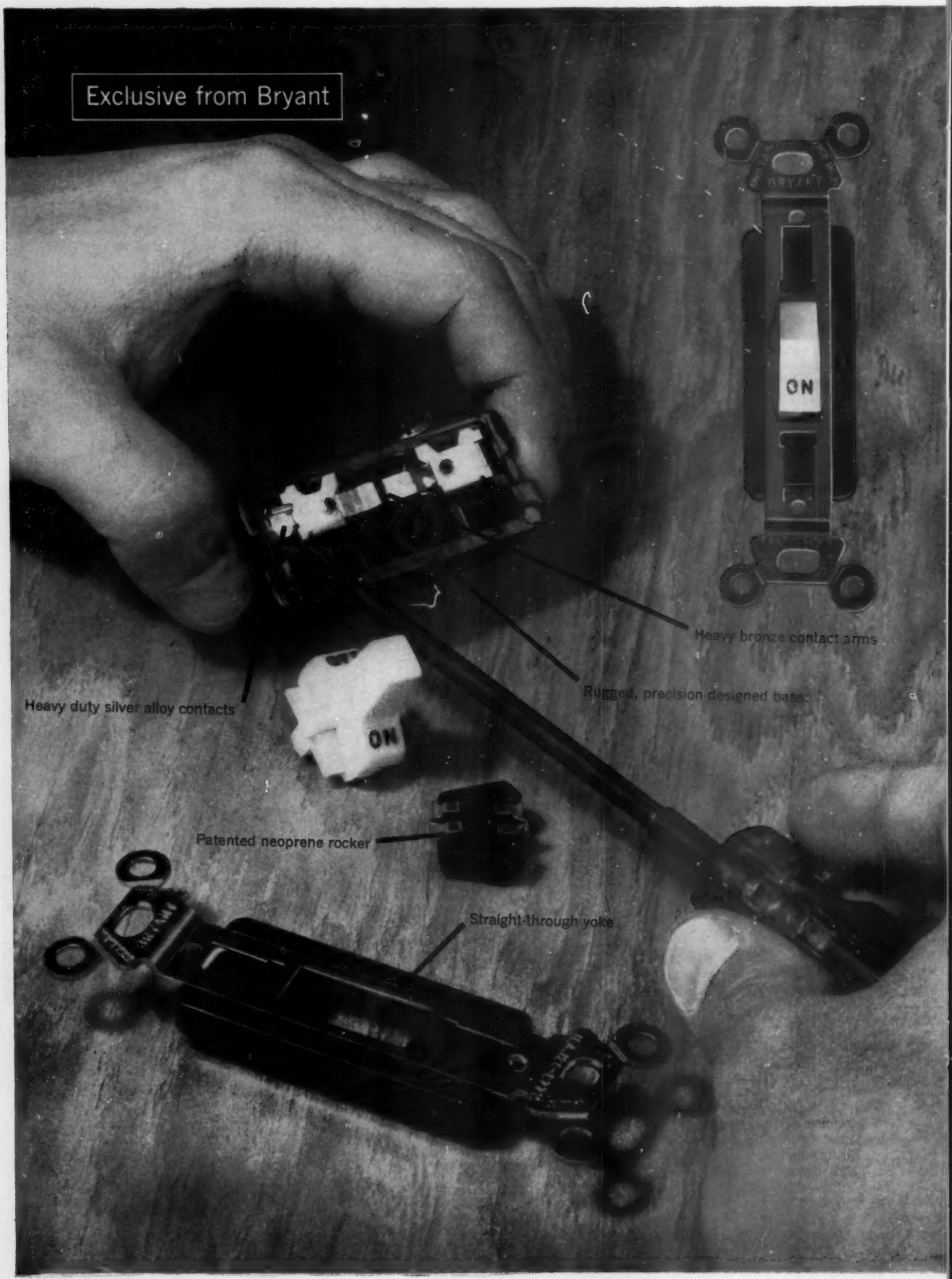
ATLANTA, 69 Mills St., N. W.
DALLAS, 1901 Griffin St.
BALTIMORE, 11 W. 25th St.

K KILLARK ST. LOUIS Killark

Write for Speedolet Catalog.

ELECTRIC MANUFACTURING COMPANY

3940 EASTON • ST. LOUIS 13, MO.


Exclusive from Bryant
BRYANT
ON
Heavy bronze contact arms
Rugged, precision designed base
Heavy duty silver alloy contacts
ON
Patented neoprene rocker
Straight-through yoke

WE TORTURED THIS SWITCH

1,000,000 Operations at Full-Rated Capacity . . . and It Was Ready for More!

You can't beat this switch for durability. Install it! Forget it! This switch will be giving faithful service when they tear down the building.

The secret is in Bryant's exclusive action and extra-durable construction. Bryant's patented neoprene rocker and toggle cam design gives this switch slow break . . . maximum closure speed . . . controlled breaking action. This means less arc, less sizzle, no contact bounce. And there are no coil springs inside to weaken or fail. You'll get a controlled contact opening to aid arc rupturing.

Look at the carefully engineered plastic base. It holds parts in perfect alignment . . . seals out dirt and dust. Heavy bronze contact arms insure positive pressure between the silver alloy contacts.

Bryant A-C Switches will handle up to full rating of tungsten or fluorescent loads, filament loads, resistant and heating loads and motor loads up to 80% of rating.

Bryant offers a complete line of quiet A-C Switches with these exclusive features . . . both residential and commercial grades. Single-pole, double-pole and 3-way. Ratings of 15 and 20 amp . . . 120 or 277 volt.

These A-C Switches are part of Bryant's complete line of top quality wiring devices. You can wisely choose Bryant for every device . . . on every job you wire. Bryant devices not only meet, but exceed Government and Underwriters' Laboratories standards. Make Bryant first choice . . . there's no need to change brands or distributors from job to job.

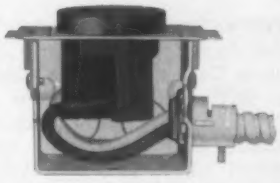
Ask your Bryant Distributor for more information about Bryant quiet A-C Switches. Let him supply all your needs with Bryant superior wiring devices.

J-99995

BRYANT THE **BRYANT** ELECTRIC COMPANY
BRIDGEPORT 2, CONN. • CHICAGO • LOS ANGELES

Grounding devices with exclusive breakaway grounding slot.

Duplex outlets with self aligning contact grips.



Range and dryer receptacles in both 50 and 30 amp ratings.

Universal weather-proof covers fc outside receptacles.

from circuses to conventions—

Lighting and electric power

◆ THE EIGHT MILLION dollar Memorial Auditorium, recently dedicated in Dallas, Texas, fulfills the long felt need for ample air-conditioned space for national conventions, exhibitions and entertainment programs previously limited to approximately 5,000 people.

The main arena, theater and committee rooms provide seating for a total of 13,370 people, plus 78,000 sq. ft. of exhibit space. The arena is a 300 ft. diameter round room without any columns to obstruct the view. Arena and theater are provided with stages. The theater stage is provided with an elevator type orchestra pit and complete stage lighting dimmer system.

Outstanding electric power and lighting features include 480 volt, three phase power distribution, lighting control to suit the use of the arena and extensive use of cove lighting. Five public address systems provide sound control. A paging system and house telephone system provide a means of contacting employees. Sixty-nine public telephones and permanent outlets for 29 television cameras provide local and national contact outside of the project.

Arena auditorium lighting

Most of the permanent seats in the auditorium are in the balcony and the remainder of the permanent seats are in several rows in front of the balcony, forming a horseshoe shaped area facing the stage. The balcony is a complete circular area 50 feet deep surrounding the 200-foot diameter main floor and extends to the circular back wall which is 300 feet in diameter.

Lighting over the balcony area is provided by 64 rows of recessed fluorescent fixtures installed radially around the circle, with each row being 40 feet long. Lighting, over the main floor, is provided by 356 high bay fixtures and 20 spot lights mounted in the 140 feet diameter acoustical saucer suspended 65 to 70 feet above the floor.

The high bay fixtures are 400 watt color corrected mercury vapor lamps and incandescent lamp spotlights help to light up the stage area and are installed in a circular pattern about the center of the saucer.

Lighting fixtures mounted in the acoustical saucer are serviced from catwalks above the saucer. Eight radial catwalks connect catwalks above the saucer to a catwalk surrounding the base of the dome, and this circular catwalk has an entrance from each of four electrical rooms located in the upper ring above the balcony.

A circular row of floodlights is also mounted on the balcony at the base of the dome to provide a band of cove lighting on the underside and around the exposed edge of the dome. Two lighting intensities are provided for general lighting of the auditorium floor, a low general lighting intensity of approximately 20 footcandles from 120 fixtures, and a high general lighting intensity of approximately 40 footcandles from 240 fixtures.

Lights are serviced from catwalks above arena, between acoustical saucer and arena dome. Eye bolts in dome ribs are for ropes to support trapezes and special lighting required for ice shows, circuses, etc.

serve Texans in Dallas Auditorium

By Leslie E. Hamilton

George L. Dahl
Architects and Engineers
Dallas, Texas

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

The other 116 mercury vapor lamp fixtures and the 20 spot lamps are used to provide additional light where needed to illuminate the required floor and stage areas for such uses as basketball, tennis, circus, boxing and stage. The lighting for each use is different and a portion of the general illumination fixtures are used along with specially placed fixtures for the particular event in question.

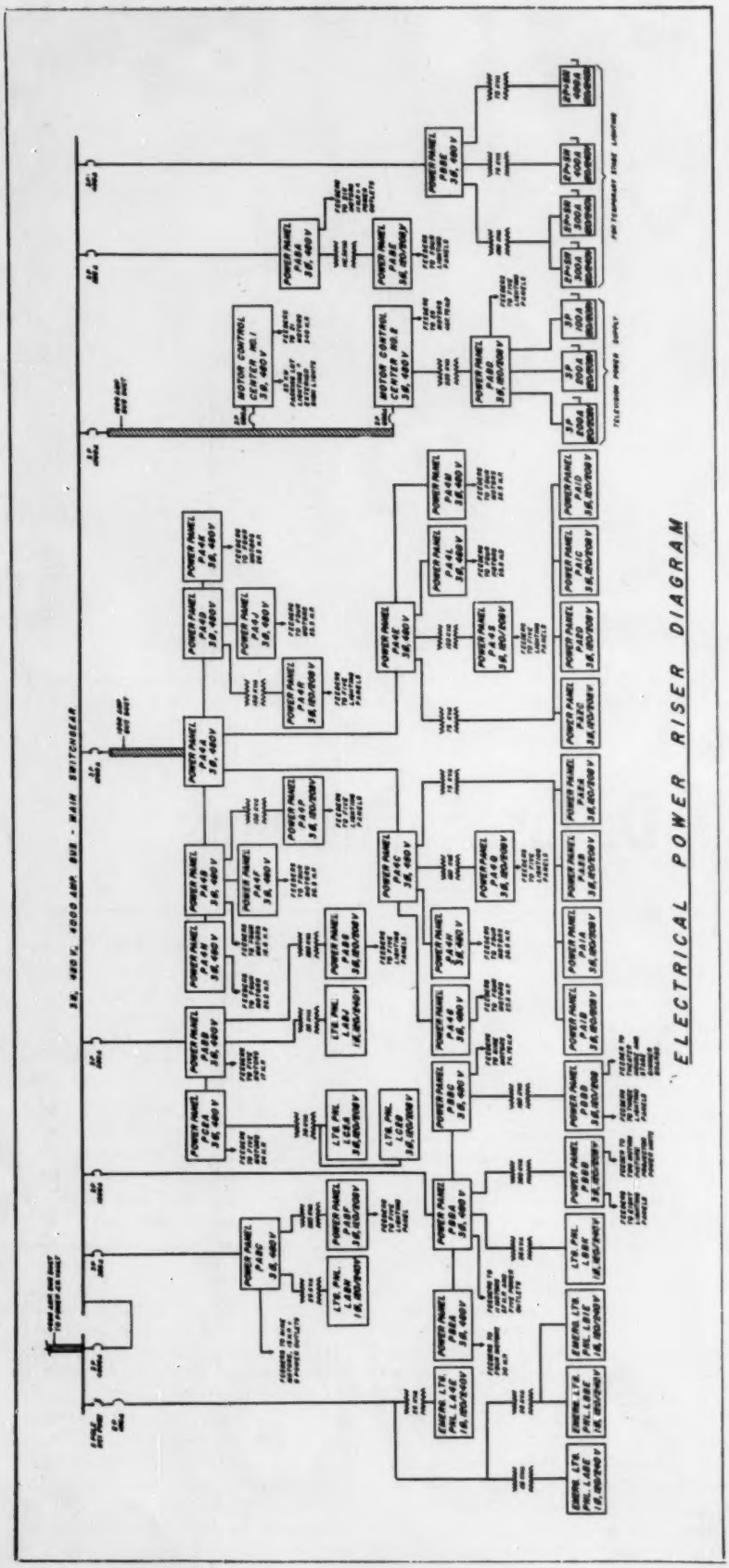
Lighting intensity is 60 to 70 footcandles for such events as circuses and 200 to 350 footcandles at the center when used for boxing and/or wrestling. These high intensities are for motion picture cameras and television cameras and are obtained by lowering the ring of lights, at the center of the saucer, down to as low as 26 feet above the floor. A winch is provided for raising and lowering this center ring of lights, and it is remotely controlled by a push button station installed behind a stage wing. Spring loaded reels retract and pay out lighting power cables as light ring is raised and lowered.

All lighting fixtures in the acoustical saucer, lights in the balcony ceiling, and lights for the dome cove are controlled at a remote control panel in the arena light and sound control room, and a smaller remote control panel for general lighting and stage area lighting is installed behind one of the stage wings.

Power for the arena room lighting system comes from eight lighting panels, two each in four electric rooms in the upper ring. Branch circuits from these panels are connected to the lights they serve through contactors. The contactors and ballasts associated with the mercury vapor lamps are mounted in light control center structures, one being installed in each of the four electric rooms mentioned above.

Groups of contactors are controlled by the operation of relays, and the relays are controlled by the operation of push buttons on the remote control panels. This arrangement makes possible the use of whatever lights are needed for any one event by merely pushing the proper row of four push buttons on the remote control panel.

To add low intensity lighting to the lights required for a particular event it is only necessary to push the low intensity button associated with that event. The operation of this button then causes low intensity lights not already used for lighting the event, to be turned on, and operation of another row of



buttons causes high intensity lights not already in use to be turned on.

Theater auditorium lighting

The ceiling and walls of the auditorium are constructed of a pattern of intricate planes made of forms and plaster, to control sound reflection and absorption. These planes form a series of surfaces at various angles and of various sizes, which provide a means of installing recessed down lights in the ceiling and cove lighting at the ceiling and walls. For most purposes the cove lights provide sufficient illumination without use of the down lights. Down lights are 200 watt incandescent lamps over the balcony area and two types of 500 watt lights over the front portion of the room, and these lights are controlled by a house lighting dimmer.

Cove lighting in the ceiling requires 272 fluorescent tubes, and they are controlled by lighting panel circuit breakers. The house lighting dimmer is of the motor operated auto-transformer type, with remote control at two locations on the stage and at two locations in the projection room.

Stage lighting

Stage lighting is provided by six arc-type spotlights, 10 stationary type incandescent spotlights, 4 light trees mounted in side pockets behind wing walls in the auditorium, footlights, 4 rows of border lights, one row of cyclorama lights, 4 portable light trees, and portable floodlights. They are controlled by a magnetic amplifier type of dimmer connected to a 1200 ampere, 120 volt power supply.

In addition to this equipment and its power supply, another power supply is available for up to 2800 amperes at 120 volts for shows furnishing and using their own stage lighting equipment.

The arc-type spotlights are installed at the back row of ceiling ports and in the projection room and are manually operated. The stationary type incandescent spotlights are 750 watt control pattern spotlights, installed at the front and middle rows of ceiling ports, and are operated in positions preset during rehearsals.

The light trees, installed in wall pockets at the side walls of the theatre room, support twenty 750 watt pattern lights. Forty feet of three-color disappearing footlights are furnished with sixty 150 watt roundels and are installed near the front of the permanent stage. The

front row of border lights include concert border lights and teaser spotlights, with 66 border lights having 200 watt 4 color roundels on 64 of them.

The other two border lights are used as work lights. The teaser spotlights include ten 500 watt theatre lights, six 1000 watt theatre lights, two 200 watt shaft lights, four 500 watt pattern lights and two 1500 watt cyclights. Border lights Nos. 2, 3, and 4 are alike and each include ninety-six 200 watt 4 color roundels. The cyclorama row includes twenty-four 750 watt cyclights.

Each of the 4 portable light trees is provided with five 500 watt theatre lights, two 1500 watt theatre lights and three 500 watt pattern lights. The six portable flood lights are 1500 watt olivetts each mounted on a telescoping floor stand. There are 8 floor pockets in the stage floor with each providing three stage lighting circuits for energizing the portable light trees and the portable flood lights.

The stage lighting dimmer board is composed of three principal parts, a dimmer unit structure, a patch panel and a remote control console. The dimmer unit structure houses 44 magnetic amplifier dimming units, 30 constant circuit control relays, a main switch, and circuit breakers for the 74 circuits mentioned above and for additional auxiliary power and spare circuits. The dimming units include twenty 3kw units, twenty 6kw units and four 15kw units.

The patch panel provides a means of manually connecting up to 200 incoming stage lighting circuits to the dimming units and to the constant circuits. Each incoming circuit is protected by a circuit breaker on this panel and a separate ammeter indicates the load on each dimmer. Provisions are made to connect as many as three incoming circuits to each 3kw dimmer, 4 incoming circuits to each 6kw dimmer and 8 incoming circuits to each 15kw dimmer.

Remote control console

The remote control console is a portable two unit structure hinged together and normally positioned 90 degrees apart so that one person can operate and control the complete stage lighting system while seated. One structure is a preset panel and the other structure houses the remainder of the control items. The preset panel pro-

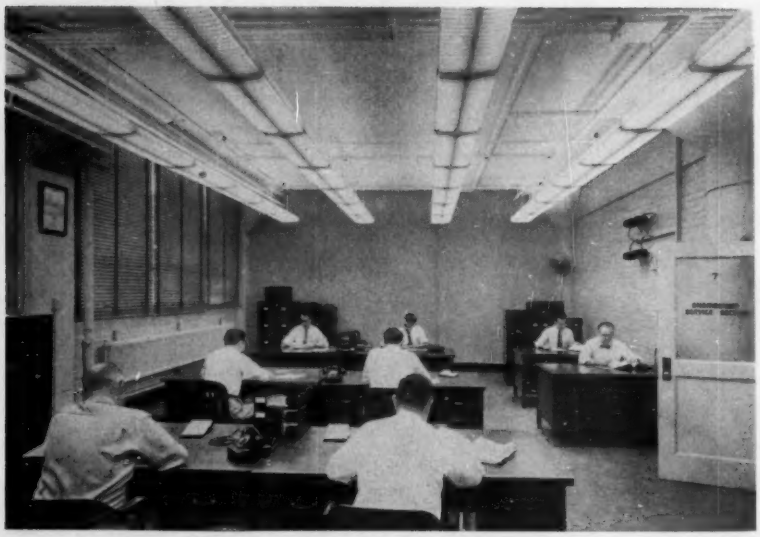
(Continued on page 104)

View of the interior of the new Dallas Arena Auditorium above shows acoustical saucer ceiling suspended sixty-five to seventy feet above the floor. Twenty spot lights and 365 high bay fixtures are mounted in the acoustical circle of 140 feet diameter. Lighting above the balcony area is provided by sixty-four rows of recessed fluorescent fixtures installed radially around the circle with each row being forty-feet long. In the upper ring area above the balcony, the windows are those of control rooms, radio rooms, press space, etc.

Ceiling and walls of the auditorium are constructed of a pattern of intricate planes made of forms and plaster, to control sound reflection and absorption. These planes form a series of surfaces of various angles and sizes, which provide a means of installing recessed down lights in the ceiling and cove lighting at the ceiling and walls.

Transistorized high-frequency power as mercury and fluorescent lighting

Westinghouse engineers examine internal construction of a new 1½ kw, 1500-cycle frequency converter developed for high-frequency lighting systems. Transistors of the type used are visible in the right foreground, and a new miniature ballast is seen at left.



This pilot installation (64 rapid start 40-watt, 48-inch T-12 lamps) of high-frequency lighting at Westinghouse is supplied power by two 1½ kw frequency converters at 1500 cycles and 150 peak volts. Frequency converter efficiency at full load is about 94 per cent.

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

◆ TRANSISTORIZED high-frequency power sources will be incorporated in standard lighting equipment in coming months. The development is expected to eliminate major technical and economic obstacles now inhibiting indoor and outdoor use of high-frequency lighting.

With continued progress in transistor production, the new lighting systems are expected to be more than competitive in price with any present day high-frequency system.

Prototypes already functioning in a lighting system for Westinghouse offices supply power at 1500 cycles to 64 standard 40-watt rapid start fluorescent lamps. Although product planning is not yet final, E. C. Huerkamp, manager of the Lighting Division at Westinghouse, has indicated that their first commercial units will not be essentially different from these prototypes. All prototype equipment built so far is designed to operate rapid start fluorescent lamps—to take advantage of the wide range of ratings available and the popularity of such lamps—but there are no obstacles to the design and manufacture of systems for instant start or preheat lamps.

Prototype power packages used in pilot installation measure 5 by 4 by 19½ inches, weigh 11 pounds, and deliver up to 1½ kilowatts at 150 volts, peak. Others have been built in ratings of three kva. At 1500 cycles, power conversion efficiency is in the order of 94 per cent at rated load, and 92 per cent at half-load. Ballasts for the pilot installation weigh only a few

applied source

ounces and are about the size of a king sized package of cigarettes; ballast losses are about 25 per cent of losses of the best 60-cycle ballasts for the same lamps.

Street and industrial uses

In the area of street and industrial lighting, the new high-frequency source is expected to benefit both mercury and fluorescent systems. For mercury lighting the principal benefits will be that physical size and weight of auxiliary equipment will be reduced; for fluorescent street lighting, benefits will stem from higher efficiency of the lamps as well as from reductions in auxiliary size.

Function of the power source

The frequency converter just announced is a static device in which incoming three-phase a-c power at normal distribution voltages is rectified by a diode bridge. The resulting d-c voltage is impressed across two groups of power transistors which conduct alternately and work with auxiliary circuits to provide a 150-volt alternating peak output.

Whether the final waveform is square or sinusoidal is determined by the circuitry of the final stage. The use of semiconductors in this design permits frequency stability to be maintained with high efficiency over a wide load and input voltage range.

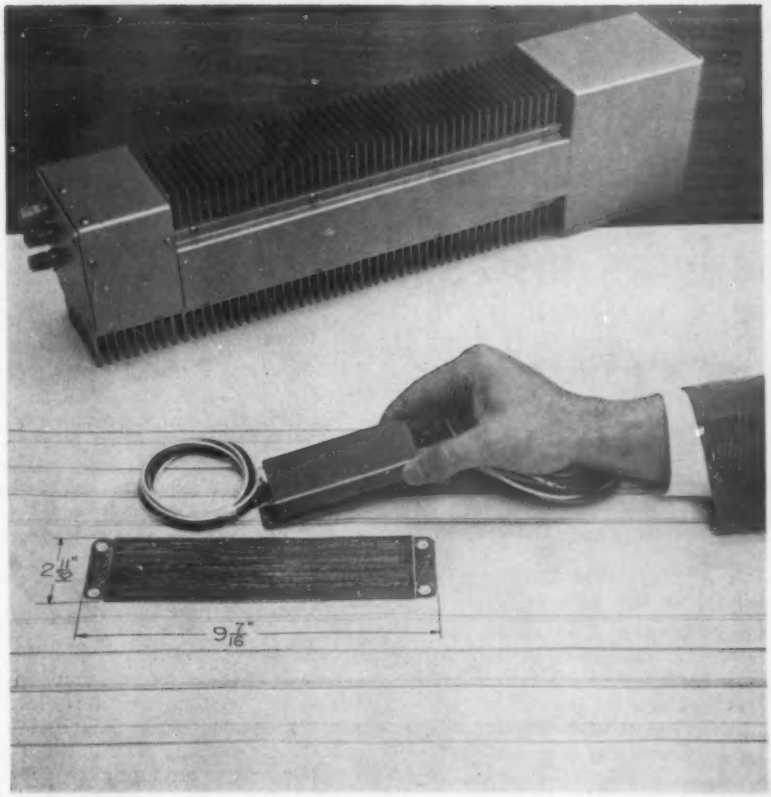
The frequency converter can be continuously energized under no load conditions since its losses are less than 50 watts. By simple design modifications, frequency output of the new units can be fixed at virtually any frequency in the audio range.

Application significance

To lighting engineers availability of high-frequency systems of these characteristics means that well-known advantages of high-frequency lighting can be more readily realized. Of these, the most

(Continued on page 103)

Packaged, transistorized high-frequency power sources deliver any fixed frequency over entire audio range. Standard three-phase power is first rectified, then converted by transistor circuits. Output shown on above scope is a 1500-cycle sinusoidal wave peaking at 150 v.



A major benefit of high-frequency lighting is that ballast size, weight, and losses can be reduced drastically, thus opening the door for major luminaire redesign. Black rectangle here shows area occupied by 60-cycle ballast for two 40-watt, 48-inch rapid start lamps. Just above, an equivalent 1500 cycle ballast. Power source at rear handles thirty-two 40-watt, 48-inch lamps.

Wiring costs for this mining power installation were greatly reduced by using continuous cable trough in place of conduit. The Cope trough units used are interconnected by pins driven through interlocking barrels welded to the ends of each trough section and fitting.

Continuous cable trough reduces installation time

By N. J. Myers
Chief Electrician

and S. J. Nameth
Mill Superintendent

Appalachian Sulphides, Inc.
Jefferson, North Carolina

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔

◆ THE REOPENING by Appalachian Sulphides of a mine originally founded in 1856 included installation of a modern flotation mill producing copper concentrates. A new shaft was put down to a depth of 1,037 feet, and drills have been put into the vein on several levels.

Power in the mill is provided by 86 electrical motors ranging from 1 to 200 hp that together total 1,200 hp. After a careful study of different types of support for these cables, expanded metal trough was decided to be most suitable. A total of 120 feet of trough in 18″ width and 150 feet in 6″ width were installed. This trough carries all power and control circuits.

Now that the electrical distribution system is complete it is clear that this type of cable supporting system offers many avantages. To handle the same amount of cable in conduit for example would have required such a jungle that wiring all of the different motors and controls would have been very difficult, even for the original hookup. Operations require changes from time to time in the wiring of the different motors and these changes are readily made with the present cable supporting system because the trough leaves the wires accessible for necessary rerouting.

And not only does the cable trough permit the rerouting made necessary by changes in the process but it greatly simplifies plant expansion. Already an expansion program has begun that will double plant output and there is plenty of room to lay the new cables necessary in the existing trough.

Probably the most important single factor in reducing cable support costs was the reduced installation time. Almost any cable trough system could be installed more quickly that conduit but in this instance a type of trough was used which, is connected by pins driven through interlocking barrels welded to the ends of each trough section and fitting. These pins are secured in a matter of seconds and the entire system can be installed at a substantial saving in labor.

Being copper miners, Appalachian Sulphides was interested to discover that the use of cable trough permitted a substantial saving in copper! Since the air is free to circulate around the cables advantage is taken of the higher cable current ratings that are permissible. If cables are enclosed in conduit, more copper is needed to carry a given load. In cable trough the heat is allowed to dissipate more readily and the smaller cables are carried the same way. The company estimates that they carry approximately 20 per cent more current than if cables were completely enclosed.

The flotation process involves the removal of copper sulfide from the iron sulfide and requires additional lime to bring the solution to a Ph ranging from 9.6 to 10.2.

The original mine was operated for only a decade or so in western North Carolina. From 1873-83 the mine produced substantial quantities of copper.

The mine was closed down in 1883, and several attempts to reopen it failed.

Later test borings by Appalachian Sulphides indicated that good grade copper and iron sulphide deposits existed to a depth of 1,200 ft. or more with substantial proved reserves. The company decided to go ahead in spite of the high costs involved, not the least of which was to drain the original shaft that had become completely filled with water.

Electrical controls in fruit processing

By Thomas L. Edwards, Engineer
and Donald D. Davidson
Department Foreman
National Fruit Product Co., Inc.
Winchester, Va.

This article should be especially helpful to the following readers:

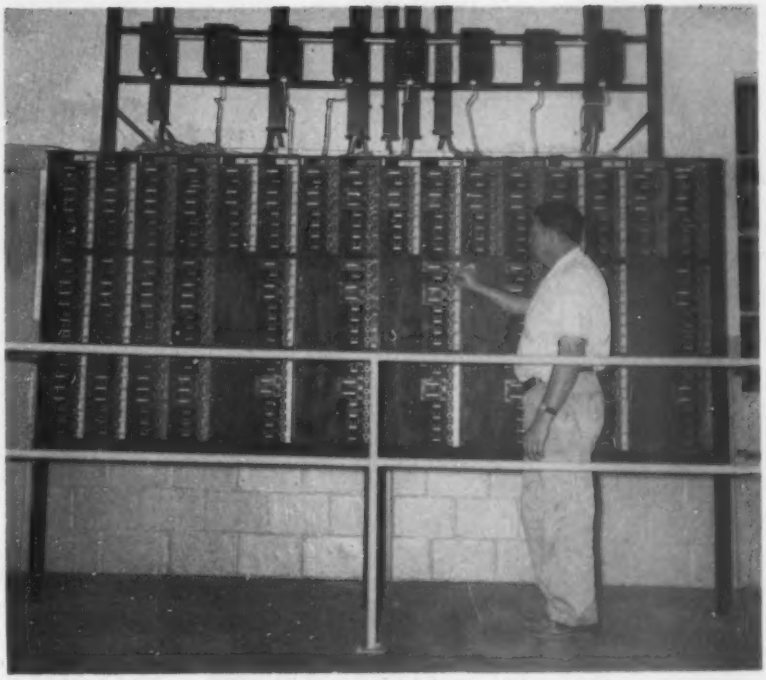
- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers ✔
- Consulting Engineers ✔

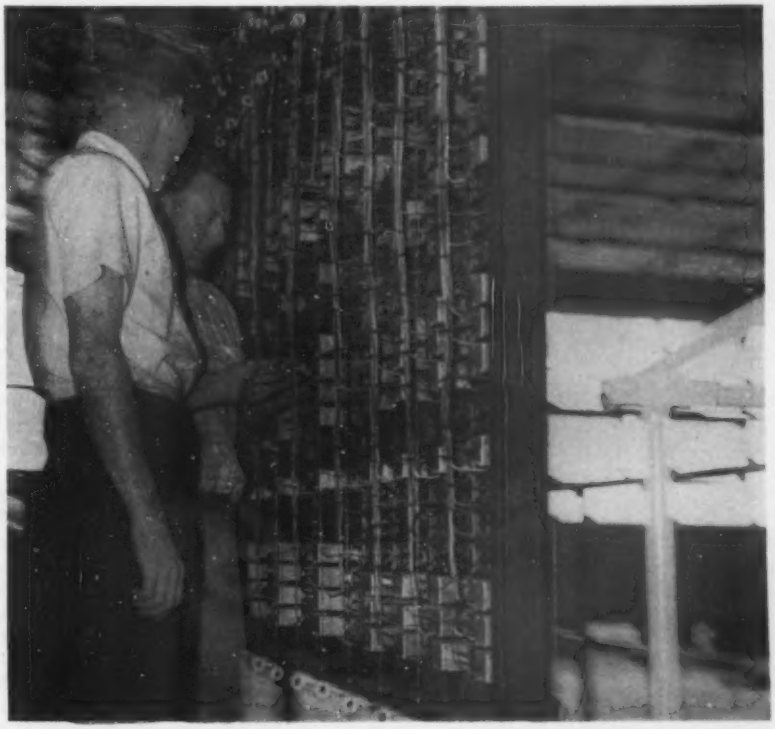
◆ SEVERAL YEARS AGO we sought some means of improving the quality of employee workmanship and introduced an incentive pay plan to reward individual effort and ability. Designing and building electrical equipment to measure and compute each individual's daily production in the processing of fruit became an important accessory to our plan. The accurate counting of each apple peeled, trimmed, sliced and dropped down the chute, and its visible record on a counting machine, were patently important to the success of our new approach. Through trial and error, working with a variety of ideas, we devised and had equipment manufactured to meet the conditions of fruit processing in measuring employee performance.

Our equipment has met mechanically and electrically most of the problems we knew we would encounter. It has helped bring outstanding success in achieving our objectives. A marked improvement in quality of workmanship has brought ten per cent of our top producers a fifteen per cent to twenty per cent gain in earnings. The average producer is ten per cent ahead of his performance prior to the incentive plan.

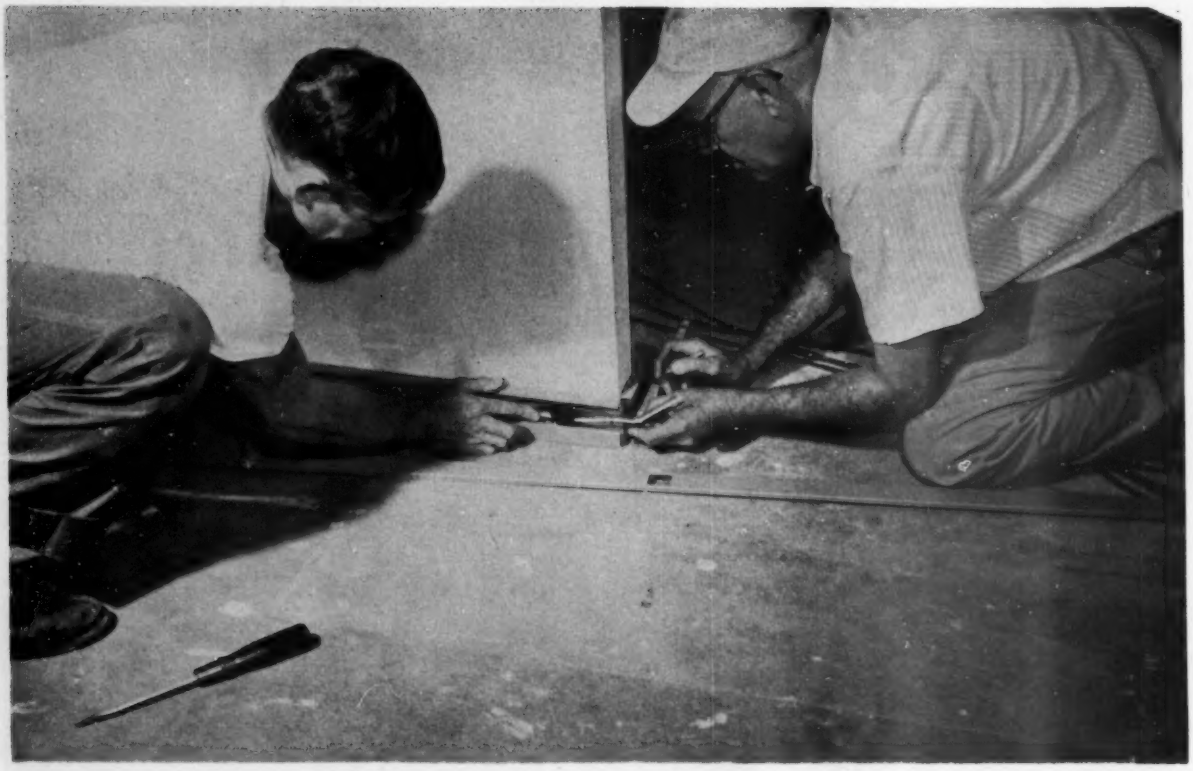
In other words, we have increased quality and quantity of production with the same number of personnel. More careful workmanship has meant a reduction in waste. Eager for maximum production and higher earnings, each employee is more alert to the op-

(Continued on page 102)





Donald Davidson, department foreman, above, checks electrical counter against table positions. Below, T. L. Edwards, engineer, and Mr. Davidson study rewiring for added positions at the worktables.



Baseboard level wiring system installed by electrical contractor

◆ "THERE'S a new way to wire houses which home builders should be looking into," says I. R. Raphael, head of the Pittsburgh electrical contracting firm of the same name. The system he refers to is Baseduct, manufactured by the National Electric Products Corp. Baseduct is a complete wiring system installed at the baseboard level, replacing standard baseboard.

Raphael's opinion is based on experience gained installing the system in the three-bedroom all-steel "Steelaire" home, a U. S. Steel prefabricated house recently built atop Kaufmann's Department Store in Pittsburgh.

Baseduct consists of an attractively designed steel raceway ¾ inches wide and three inches high which is installed flush with the wall and floor. It requires no trim of any kind. By removing a panel from the face of Baseduct access to the wiring is obtained. Wiring harness for duplex outlets on 60-inch or 30-inch centers is installed within the duct without screws or bolts. A single piece fitting serves as filler for both inside and outside corners.

This article should be especially helpful to the following readers:

Electrical Contractors	✓
Electric Utilities	✓
Electrical Wholesalers	✓
Electrical Inspectors	✓
Industrial Engineers	
Consulting Engineers	✓

Working with the system for the first time, Raphael's electricians were able to install 170 feet of Baseduct in less time than required for conventional wiring. This was for a complete installation, not requiring a return to the job to install device bodies and cover plates.

"The system incorporates a duplex outlet every 60 inches, or less where required," the electrical

contractor pointed out. "Baseduct provides more than an 'adequate' wiring job, as we know it today."

Because of Baseduct's construction, which has raceway provision for ten additional conductors, new circuits as well as new devices can be added at any time. All that is required is to remove the cover, lay in the new wires, and replace cover.

Raphael suggested this be compared with the two-story house just acquired by remodeling-minded owners. "If they find they need one additional device in each of six rooms they can easily end up with a bill of $100 for the electrician. It won't be an easy job to find places to run additional wires or to fish them. Plaster, wallpaper and paint may be marred and the home owner will generally be exasperated by the time the job is complete. With Baseduct it's a breeze.

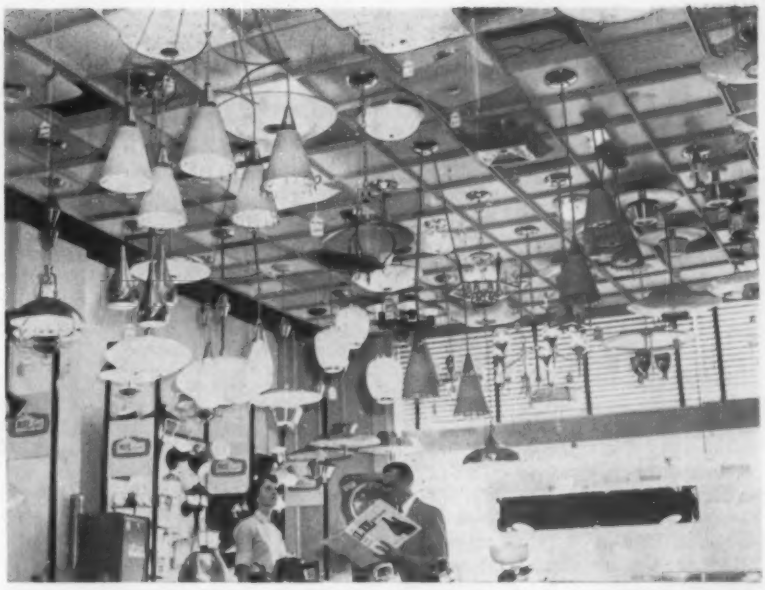
"The biggest thing about the wiring system," according to the seasoned contractor, "is the built-in sales advantages for the builder.

"Baseduct is virtually scuff-proof, we didn't mar any of it while installing. By exercising care in cutting the duct, good joints were made which were completely concealed with one coat of paint. The system accommodates any furniture arrangement because there are duplex outlets all around the room. The system provides for additional circuits for color-TV and even for appliances which haven't been invented yet, but which will be commonly used in homes ten years from now."

According to L. D. Shank, sales manager of National Electric, several large prefabricated home builders are now checking the system to compare costs and convenience and sales advantage. An apartment house developer is planning to use upwards of one-half million feet in a new multi-dwelling project.

Of all the breakthroughs which have been tediously worked out in prefabricated housing packages, the manufacturer feels this may be one of the most significant electrical advancements to date.

"Baseduct makes possible to the prefabricator a completely integrated wiring system," W. W. Brewer, product manager says. "With the base mounted on the wall panels, all that is required for a complete installation is to lay in special circuits as necessary, 'rock in' the preassembled receptacle harness and replace cover."

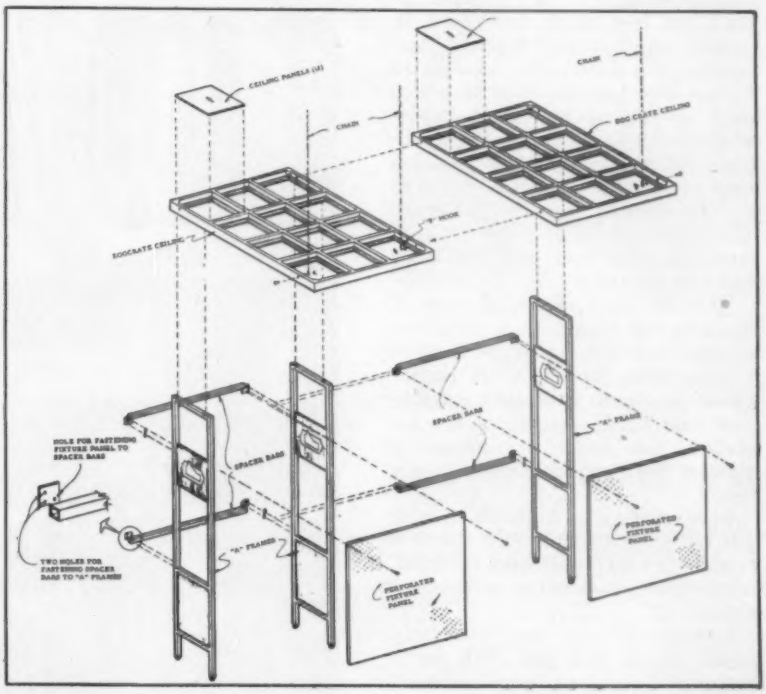


Modular ceiling beautifies fixture displays

◆ THIS modular ceiling lighting fixture showroom, above, at Lowe Electric Company, Macon, Ga., is the first of its type specifically designed for fixtures by Moe Light Division, Louisville, Ky.

An attractive merchandising tool, the showroom is shipped complete in component parts, quickly assembled by the customer, and said not to disturb normal selling operations.

Egg-crate ceiling sections and pegboard wall panels come equipped with outlets, sockets, and mounting panels. Easy-to-follow instructions are also included.



Units comprising the Moe modular display ceiling, above, consist of "A" frames, spacer bars, fixture panels, and egg-crate ceilings.

An estimator and his methods

By Harry J. Miller

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers ✔

◆ POTENTIAL estimators are garnered from the more capable employees of Doyle Electric Co., of St. Petersburg and Tampa, Fla., on their proven ability to shoulder responsibility. They are trained step-by-step in their new duties and aided by full and comprehensive catalogs and a complete library on accepted estimating practice.

Says Lyman D. Turner, once a superintendent, and trained by William H. Doyle as an estimator: "Say we're using a labor unit of 4 hours to install 100 feet of ½-inch rigid conduit. Listed on the back of the foreman's report may be an item reporting 8 hours for installing 250 feet. Thus our figure of 4 hours is okay to use.

"But a new man on the job may require some time to read the prints and orient himself. However, taken over a sufficient number of jobs, we develop an average figure that makes a correct labor unit.

"For example, a published price may indicate labor of 5 hours to install 100 feet of ½ inch conduit, against our figure of 4 hours. Reason for the difference is indicated by our own job cost records, which may reveal we had good supervision, or the job and soil conditions were in our favor. Take the case of $300,000 worth of work in St. Petersburg we did recently. There were a lot of small jobs included in this sum, and our labor cost ran $160,000.

"Yet we did a similar amount of work in the Tampa area, at a cost of only $100,000 for labor. But in Tampa, the jobs ran in higher brackets. Again, as where switchgear and kindred fixtures are installed, the labor percentage is smaller than on conventional wiring."

In executing a $100,000 wiring job on a Medical Center, Doyle's costs for material ran $60,000, while labor racked up a total of $20,000.

Lyman credits the resulting profit to the fact that "We get a definite figure on our material cost, while labor costs are our variable."

Post-mortem on a job running $15,461.67 indicates some salient figures, as well as Turner's meticulous methodry in compiling an estimate. On this job, the breakdown indicates:

Labor costs of 961 hours @ $3.30 an hour	**$ 3,171.30**
Total material cost	**10,433.99**
Job expense	**700.00**
Bond—$150	
Sales taxes—$450	

(Continued on page 104)

Estimator Lyman D. Turner makes frequent use of catalogs and books on estimating practice from the Doyle Electric Company library.

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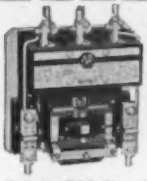
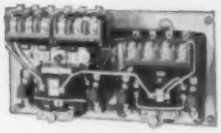
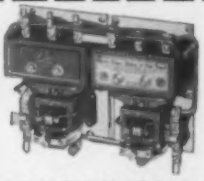


Bulletin 709 Size 4 Automatic Starter—50 hp, 220 v; 100 hp, 440-550 v.



Bulletin 715 Size 1 Two Speed Consequent Pole Starter.

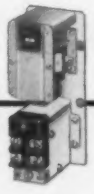


Bulletin 705 Size 2 Reversing Starter. Max. rating: 15 hp, 220 v; 25 hp, 440-550 v.

Bulletin 646 Manual Autotransformer Starter.

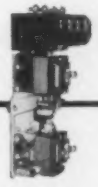
Bulletin 802T Oiltight Limit Switch.

Bulletin 802 Oiltight Precision Limit Switch.

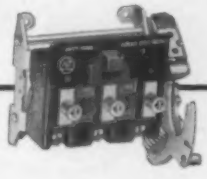


Bulletin 849 "On-Delay" Pneumatic Timer.

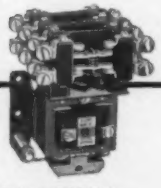
Bulletin 808 Zero Speed Switch.



Bulletin 704 Mechanically Held Relay. Noiseless.

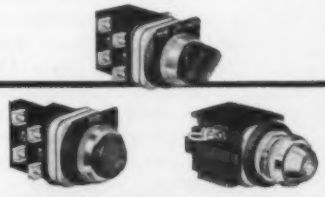


Bulletin 894 Visible Contact Disconnect Switch.

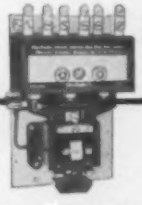


Bulletin 700 Universal Relay with N.O. —N.C. Contacts.

Bulletin 200 Direct Current Relay.



Bulletin 800T Oiltight Push Button, Selector Switch, "Press-to-Test" Pilot Light, and assembled Oiltight Station.



Bulletin 702 Three Pole, Size 3 Contactor—100 ampere.

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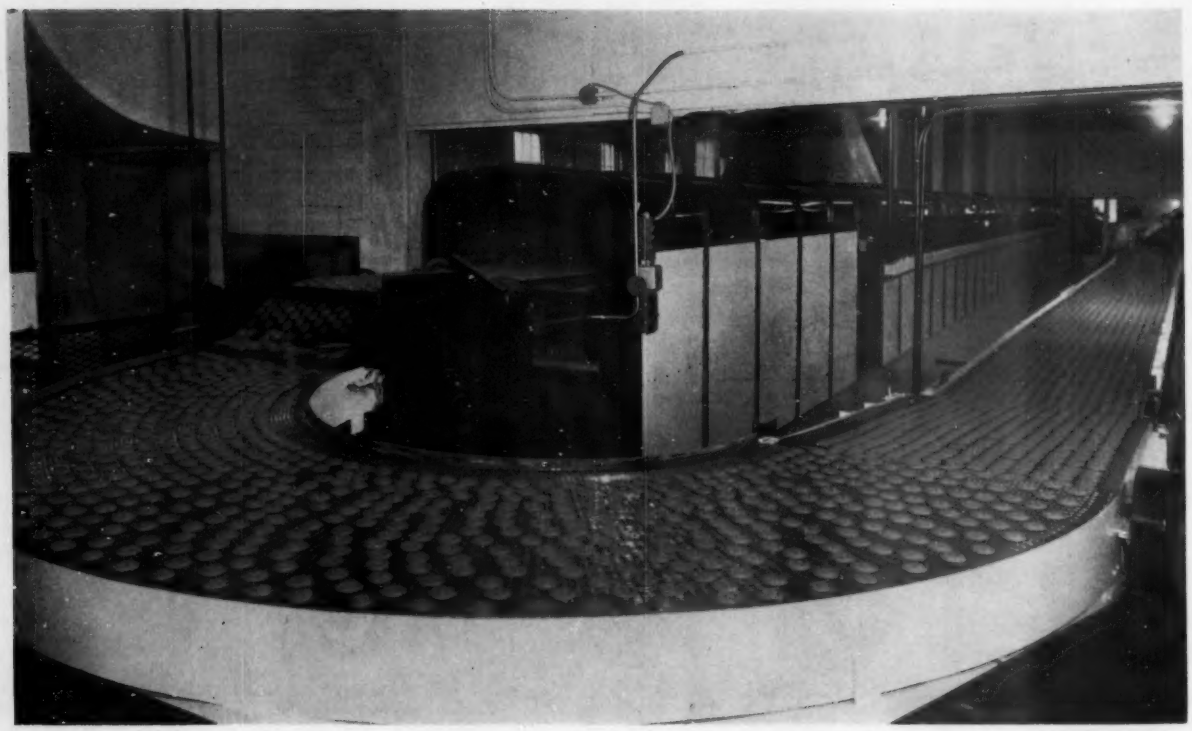
MEMPHIS—Curtis H. Stout of Tennessee, Inc., 718 M & M Bldg., Tel: JAckson 6-7601
MIAMI—Charles R. Lee & Assoc., Inc., 3524 W. Flagler St., Tel: FRanklin 1-6766
NEW ORLEANS—Robbins & Robbins, 1037 Magazine St., Tel: Canal 5805
RICHMOND—H. M. Wood & Co., Inc., 2016 Second Ave., Tel: 3-8529
ST. LOUIS—Harold Julien, 904 N. Grand Blvd., Tel: JEfferson 5-1901
SAN ANTONIO—Wilson Electrical Equipment Co., 101 E. Maple St., CApitol 4-2344
TAMPA—Robert P. Smith & Co., 3611 So. Coolidge Ave., Tel: 61-5211
TULSA—John W. Elder Co., 1526 E. Fourth St., Tel: Diamond 3-9149



Bakery modernizes with electric band oven

By H. C. Hartman
Industrial Engineer
Nashville Electric Service

and W. F. Connellan
Commercial Cooking Specialist
Frank Cookie Company
Nashville, Tenn.

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

◆ WHEN the Frank Cookie Co., of Nashville, Tenn., a 34-year-old firm, decided to modernize their bakery, they chose an electric band oven to replace their two outmoded gas ovens. The result was a more economical operation and a superior product.

In the past year the volume of business increased to the point that some changes in production were necessary to keep pace with the demand. Electric baking ovens of the batch type had been used in the past.

Being familiar with the performance of these ovens and well satisfied with their operation, they employed the Advance Oven Company of St. Louis to design and build an electric oven of the band type which would take care of their needs.

The oven is 100 feet long with an additional 25 foot cooling tunnel. The band is made from Swedish steel and is driven by a 1½ hp motor. There are automatic cutters at the oven entrance and a space is provided between the oven and the cooling tunnel to accommodate the icing machine.

The area at the oven entrance immediately surrounding the cutting machine is enclosed and air conditioned. The oven contains 198 kw of tubular metal sheathed heaters equally spaced over the 100 feet with one half of the heaters above the band and the other half below.

In order to provide the proper control of temperatures throughout the oven, it is divided into three zones. Each zone is separately controlled by a thermostat. A certain number of the heaters in each zone are controlled manually from a fused safety switch. Each thermostatically controlled zone consists of 44 kw of heaters, while a total of 66 kw is manually controlled.

The thermostatically controlled heaters and the band are also regulated by a time clock. The clock turns the oven on at 6:00 a.m. and the oven requires an hour and fifteen minutes preheating. The time clock also shuts the oven off automatically at 4:45 p.m. This automatic control affords a great savings in labor.

The oven is fed from a 240 volt, three wire, three phase, power service. Each group of three heaters is connected in wye producing a voltage of approximately 133 volts across each heater. The heaters were designed for the voltage and each has one cold end of about six inches. The reason for this cold end is to allow one end of the heater to extend through the oven wall into a junction box for making electrical connections.

With this type of connection the neutral point of the wye connection of each group is on the same side of the oven, thus making all terminals brought out through the oven wall on the same side, greatly facilitating the wiring. The oven

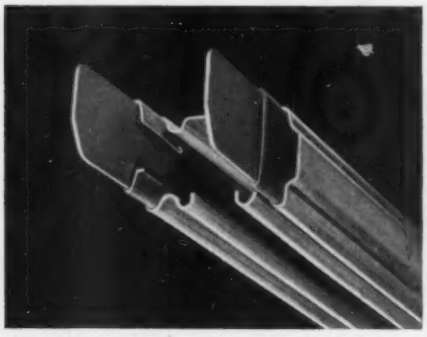
(*Continued on page 104*)

New Universal Lighting System—

for flexible, low-cost lighting

Provide efficiency and economy, too. BullDog's new 20-amp Universal Lighting System both feeds and supports lighting fixtures . . . requires no supplementary fusing. Fixtures can be positioned at any spot throughout the entire system . . . are quickly and easily moved to meet changes in lighting requirements. No rewiring or electrical downtime, either.

Listed by Underwriters' Laboratories, this new Universal Lighting System assures maximum flexibility at minimum cost. Check its many advantages. Consult your electrical distributor or BullDog field engineer. Or write BullDog Electric Products Co., Detroit 32, Michigan. © BEPCO



CROSS SECTION of new, low-cost 20-amp Universal Lighting System. Movable weight supports and twistout plugs speed rearrangement, addition or removal of fixtures, eliminate rewiring and electrical downtime.

BULLDOG

BullDog Electric Products Co., Detroit 32, Mich. A Division of I-T-E Circuit Breaker Co.
BullDog Export Division: 13 East 40th St., New York 16, N.Y.
In Canada: BullDog Electric Products Co. (Canada) Ltd., 80 Clayson Rd., Toronto 15, Ont.

Consult the following Southern representatives:

Wilson Electrical Equipment Co.
2930 Commerce St., P.O. Box 1725
Houston, Texas

Standard Electric Mfg. Co.
2401 Federal St., P.O. Box 1138
Dallas 1, Texas

Walker Electrical Co., Inc.
125 Bennett St., N.W., P.O. Box 8, Sta. D
Atlanta, Georgia

Observing NATIONAL ELECTRICAL WEEK

Contractors tell how

Combination connector used by contractor

◆ ELECTRICAL CODES called for liquid-tight connectors properly insulated, gasketed and grounded for terminating liquid-tight flexible metal conduit at cabinets, junction boxes and pull boxes. Standard connectors, which do not have adequate threads to accommodate a gasket assembly, box wall thickness, a locknut and an insulated bushing, would have required additional installation time and labor and taken space in the boxes needed for conductors.

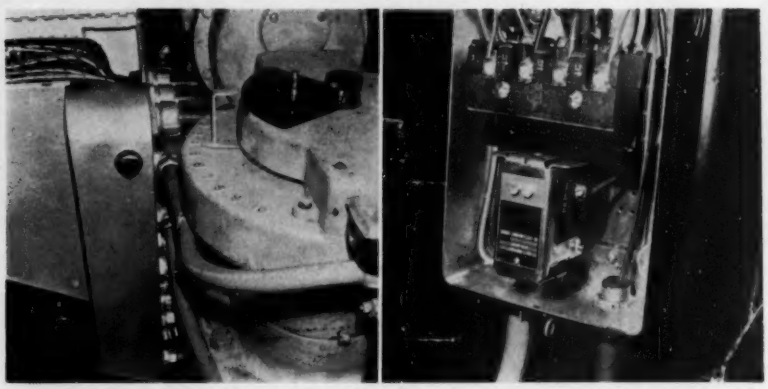
Equipment involved were heavy printing presses at the Miami *News*, Florida. Press operation would cause severe vibration along raceways, shaking conductors and making insulating bushing protection for conductor insulation especially necessary.

Use of liquid-tight connectors with integral insulated throats, a combination fitting recently designed by The Thomas & Betts Co., filled code requirements and eliminated the installation and space problems. The built-in insulation saved on the extra time and effort spent to handle and install separate bushings which standard liquid-tight connectors require.

Space was at a premium in the boxes because each was crowded with many small control cables. The separate bushings of the standard fittings would have taken space all around the connector, overlapping in some cases on other knock-outs of the box. The built-in bushing, lining the throat and edges of the connector, occupied no space in the boxes.

The liquid-tight connector with the built-in insulated throat includes a steel grounding cone and a Zytel sealing gland, exactly like uninsulated liquid-tight flexible conduit connectors. Besides sealing tightly, the Zytel gland also protects the raceway's plastic jacket.

Cornelius Electric Company, of Miami, electrical contractor for the new plant, noted that the smooth insulated throat also facilitated wire pulling. According to the manufacturer, the insulated throat cuts wire pulling friction about 50 per cent.



Flexible liquid-tight conduit snakes through tension switches into control terminal cabinet (left photo.) Vibration from nearby equipment causes conductors to shake against walls of conduit, but built-in insulated throats of the liquid-tight connectors protect conductor insulation at termination points. Liquid-tight connector in lower right corner of box shows built-in insulated throat (right photo).

Wholesaler tells contractor "how"

By Sam Barmack
President
Columbia Electric Supply Co.
Washington, D. C.

◆ AS A FORMER electrician, electrical contractor and employee of an electrical fixture manufacturer covering over thirty years, I believe I am witnessing the rise of certain problems in the wholesale electric supply field that have become intensified recently threatening the wholesale trade. I believe I have retained the contractor's point of view and can therefore see his position. That is why I am calling attention to a situation that only he can correct.

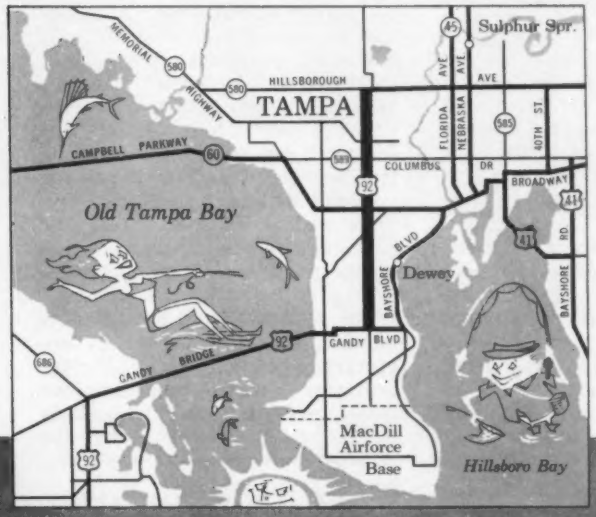
To a great extent the lighting fixture business has disappeared from the electrical contractor's business. He has permitted the builder and building contractor to do their own purchasing of lighting fixtures, leaving to him only installation. Insistence on controlling the lighting fixture end of the deal as well as installation should be a part of his approach to the acceptance of a job.

But the electrical contractor may

There are brighter nights ahead...and HAPCO points the way

Day by day, the rapid growth in our network of freeways, express roads, parkways and toll roads becomes more apparent. Each business trip, every vacation tour exposes wider, straighter, smoother and safer highways. At night, thanks to modern lighting methods, these "super" expressways maintain high levels of visual safety. Slim, trim Brackets and Poles by Hubbard Aluminum Products Company support the luminaires in an ever increasing number of these modern installations.

For example, a recent Florida installation by Tampa Electric Company lights up a busy seven mile stretch of four-lane Dale Mabry Highway. From the northern City Limits to Gandy Boulevard, traffic moves easily and safely, day and night, over this heavily travelled section of U. S. Route 92. The job required 259 mercury vapor luminaires, all supported by HAPCO Brackets. In the complete HAPCO line of Standards and Brackets are designs for all types of modern, low-maintenance outdoor lighting installations. For more information, write to Hubbard Aluminum Products Company, 6301 Butler Street, Pittsburgh 1, Pa.



HUBBARD ALUMINUM PRODUCTS COMPANY

Division of Hubbard & Company
Pittsburgh 1, Pennsylvania

Tampa, Florida—Seven miles of brilliant mercury vapor lighting shows the way along Dale Mabry, one of Tampa's main traffic arteries. The 259 luminaires are mounted on 208 HAPCO 8-foot Brackets and 51 HAPCO 6-foot Brackets.

A portion of Columbia Electric Supply Company's attractive fixture displays provided for convenience of the electrical contractor and his customers.

raise the question of how he is going to stop the electrical supply wholesaler from selling to the builder and building contractor. My answer is there must be closer cooperation between electrical contractor and electrical supply wholesaler for mutual protection.

The electrical contractor has failed to protect his own interests when he shops around at various wholesale supply houses and reveals to the wholesaler's competitors prices offered him.

Penny-saving has reached the point where the wholesaler who undercuts his competitor by 50¢ is the one who makes the sale. In the meantime he has learned the inside business story of his competitor.

Too often the contractor sends a homeowner in with the statement to the wholesaler that "she is to be given cost on the fixture as if you were selling to me." There is no reason why the public has to be let in on our business arrangements or costs. I feel no obligation to tell or sell a homeowner a lighting fixture at what I would give it to the contractor. The contractor undermines his own business when he lets his customers know what his costs of materials are.

Both electric contractor and wholesaler have to wake up and take stock of what is happening in the business. Unless we exercise some restraint and show some foresight and business ability, we shall be going the way of the discount house.

Electrical contractors should recognize that a wholesaler has to make a legitimate profit. He operates a showroom of fixture displays, has trained personnel to sell them, maintains a parking area for the contractor, carries an inventory for the contractor—the entire structure of his operation requires some legitimate margin. Why shouldn't contractors be willing to pay a little more for their materials at a legitimate wholesale price instead of shopping around? We in turn would support the electrical contractor by limiting lighting fixture sales to none but him.

Signs tell prospective customers of various services offered

By S. W. Ellis
Little Rock, Ark.

◆ SIGNS ON PARKING LOTS and on the sides of their buildings list all services offered by A & J Electric Co., operating at both Little Rock and Conway, Ark.

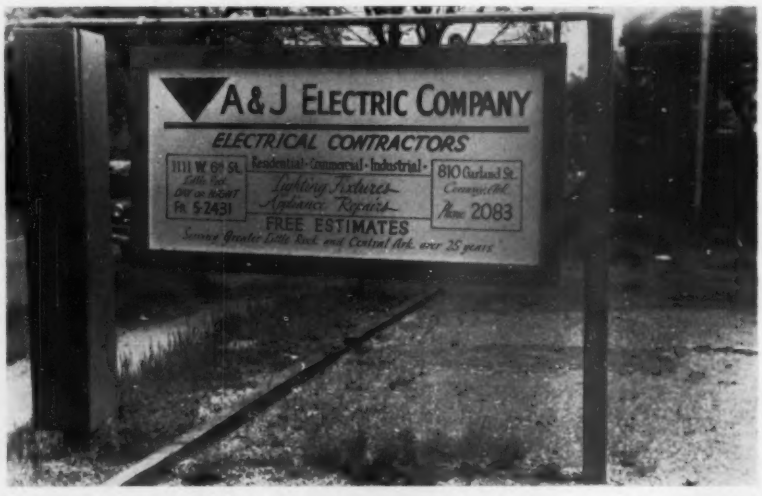
In line with a continuous program aimed at holding old customers and building repeat business, the neatly-lettered signs, also appearing on the trucks, are regarded as billboards which carry a dozen sales messages.

One parking lot sign hangs from a specially-constructed stand at eye level, near the sidewalk. Both sides of the large board are identical, so that motorists and passers-by can read from either side.

Other signs in the parking lot and on the building list such services as electrification of antiques and small appliance repairs.

Owner J. P. Nabholz, with 31 years of electrical contracting experience behind him, believes that the small services which some contractors consider unprofitable are goodwill builders and help to promote repeat business from old customers. Wiring antiques is one of these services. Cleaning window- and attic fans is another.

The outdoor signs, kept freshly painted, are regarded as an important advertising medium, coordinated with mimeographed postal cards that go out regularly to old customers, and with the sales training given to every member of personnel.



Colorful, freshly-painted signs, such as this, may be seen near street areas and on the parking lots of the A & J Electric Co., of Little Rock and Conway, Ark. Owner J. P. Nabholz maintains that they do wonders for goodwill building and promote repeat business from old customers.

T-lug accommodates one size larger tap than line wire—widely separated from line to minimize galvanic corrosion.

Only 3-11/16 inches high. Streamlined and compact. Adaptable for use on small stirrups.

Screw chamber lubricated for full thread protection.

Internal jaw stop engages in body channel to limit travel, prevents jaw and body from separating.

NEW KEARNEY

3532-series protected-thread HOT LINE CLAMP

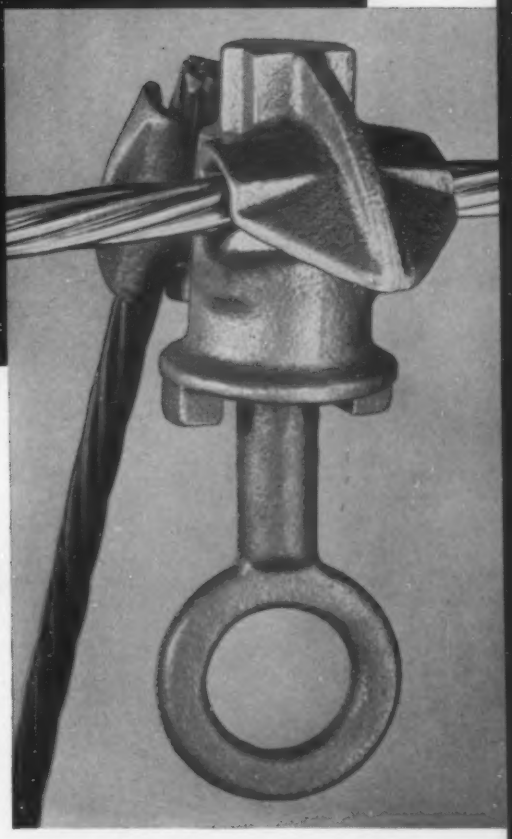
assures positive current transfer...

Accommodates all-conductor combinations—copper-to-copper, copper-to-aluminum, aluminum-to-copper, and aluminum-to-aluminum.

Kearney's newly-designed 3532-series hot line clamps are available as follows:

Line Side Range

ALL BRONZE BODIES	#6 Sol. Cu.—#2 Str. Cu.
ALL ALUMINUM BODIES	#6 Sol. Al. —#2 ACSR
FULLY PLATED BRONZE BODIES	#6 Sol. —#2 ACSR
Tap Side Range	#6 Sol. —1/0 ACSR



Wide, deep-seated contacts match line conductor contours, long-line contact surface assures positive current transfer between each outside strand and clamp.

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Understanding the Code

By Walter R. Stone

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electrical Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔

◆ LAST MONTH we ignored the inability of many electricians to distinguish one color from another and cited a code requirement that colors be used in certain specified ways and only in such specified ways.

Or did we? I'm afraid that it is not quite so simple as that, though at times I have wished that it were possible to lay down hard and fast rules. But the business of electrical wiring becomes so involved that it frequently becomes necessary to resort to exceptions to the rules which by necessity are quite flexible rather than hard and fast. In this issue, we will attempt to clarify some of these rules.

Many rules cannot be simplified. If they were simple, they would be simply stated in the Code. Moreover, if they were simple enough, wiring installations could be, and would be, made by cheap, unskilled laborers. Those who recognize the inevitability of the complications and accept them as such are the ones whose frame of mind is conducive to understanding and mastering the subject.

Therefore, instead of wasting time trying to simplify naturally complicated rules, we will, instead, recognize our problems for what they are and attempt to clarify them until they can be understood.

With this in mind, let's thrash out color coding before we go on. There are only two colors which the Code says must be used for, and only for, certain purposes. These two colors are green and white. And even one of these—white—has allowable exceptions. Furthermore, a bare conductor may be substituted for green.

All of the other colors mentioned by the Code have governing rules, but with many exceptions. A look at the reasons for color coding will aid greatly in understanding both the rules and the exceptions.

Since we know the Code is concerned with safety, we can list several reasons, aside from convenience, for color coding as follows:

(1). To be able to distinguish which is the equipment grounding conductor and to prevent interchanging it with circuit conductors.

(2). To be able to identify the neutral conductor at all times and places and to prevent improper connections.

(3). To be able to balance the load throughout the system.

(4). To prevent the connection of two or more circuit conductors from the same phase to a common neutral.

To dispose of them in easy stages, consider first the equipment grounding conductor. This conductor is required to be either green or bare. There are no exceptions to this rule. Furthermore, green cannot be used for any other purpose. Bare conductors, however, can be used for other purposes, such as for a grounded service neutral where the voltage to ground does not exceed 300 volts.

Other permitted uses of the bare conductor are for the common ground conductor at or ahead of the service switch connecting both the system and the equipment grounds to the ground electrode; for ranges, clothes dryers, and feeders from a service cabinet to

Questions on the Code

In a previous discussion, it was stated that we would return later to section 1109, under the heading "General," which states "Devices intended to break current shall have an interrupting capacity sufficient for the voltage employed and for the current which must be interrupted." Based on that section, we now have the following question:

QUESTION: A 50-amp circuit breaker protecting a 40-amp motor load is supplied by a 220-volt transformer with an impedance of .01 ohms. If a short circuit occurred at the load terminal of the breaker, would it be required to interrupt 40 amps, 50 amps, 500 amps, or 22,000 amps?

ANSWER: The most nearly correct answer is 22,000 amps. Computing interrupting capacity is a very involved process and should be referred always to qualified engineers rather than attempted by the electrician or electrical contractor. However, both should have some acquaintance with the problem in order to prevent a catastrophe. Each should know when to seek advice. The accompanying sketch illustrates our question and the answer which is approximate. In the next issue, we will have a more complete discussion of the principle.

Transformer is supplied from network of "unlimited" capacity. At secondary of transformer, voltage, E, is 220; impedance, Z, is .01 ohm; short circuit current, I, is 22,000 amperes, approximately.

Motor load is 40 amperes at 220 volts. Apparent impedance, Z, is 5.5 ohms. This has little relation to magnitude of short-circuit current.

- One single instrument with internal limit switches for limiting the range of operation.
- Positive assurance that limits are set on one of the designated operating points.
- Equipment need not be de-energized to adjust the limit levels.
- Raise and lower limits may be set independently.

LOAD RANGE SELECTOR

Supplied on Westinghouse single-phase, type URL and URF, feeder voltage regulators; on all standard three-phase type URS voltage regulators rated 750-kva and below.

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supply other buildings when Type USE cable is used with an outer covering and the voltage is a-c and not over 150 volts to ground; for certain out-of-reach locations which are not accessible to unqualified persons, such as bare-conductor feeders, crane contact and trolly conductors; for X-ray conductors; and for transmission and distribution purposes. All of these things, however, are of a nature not easily confused with equipment grounding conductors. Therefore, confusion is not likely to result by permitting the use of bare conductors for equipment grounding. When an insulated or covered wire is used for equipment grounding purposes, however, it is required to be green.

(As an aside here, let me mention that radio and television standards differ from wiring standards. For instance, they use black for grounding instead of the long established green. Those of you who work or contract in both fields will be confronted with two standards. It is a pity that RETMA did not choose to use our established colors instead of selecting new ones. I mention this because of the increasing use of electronic equipment.)

The grounded neutral conductor is required to be white (or light gray). A white conductor, however, when part of a cable, may be used for a phase wire provided that it is painted at the outlets where they are visible or accessible, such as at the terminals or junction boxes where connections are made.

A white conductor, again when part of a cable, may be used for switch loops without being painted at the terminals provided that the unidentified conductor (not the white) is used to return from the switch to the outlet. Since a white neutral is already in the outlet, a return from the switch must be a different color to distinguish it from the neutral.

The colors between 3-way and 4-way switches may be arranged in any manner just so long as the white is not used as the return to the outlet.

If a "high-leg" (the conductor with the highest voltage to ground on a 4-wire delta-connected secondary) and a neutral are both present at any point where any connections are made, the "high-leg" must be painted or permanently marked to distinguish it from the other phase conductors. This is a requirement designed to prevent a supposedly 115-volt connection to a 208-volt source.

The remaining reasons for color coding are all provided for by the remaining rules which govern the phase conductors generally. The phases should be, according to the number of them, black, red, blue, and yellow in that order, though it is rare nowadays to find the need for the yellow or fourth phase color.

The exceptions here are the most confusing and the least understood. The two sentences causing much of this confusion follow: "If

(Continued on page 103)

Code test questions

1. Branch circuits supplying receptacles of the standard 15-ampere or less rating shall not exceed 150 volts to ground. True or false?

2. In dwelling occupancies, the voltage between conductors supplying only portable motor-operated appliances of ¼ hp or greater shall not exceed 150 volts. True or false?

3. In dwelling occupancies, the voltage between conductors supplying only permanently connected appliances or portable appliances of more than 1380 watts may exceed 150 volts. True or false?

4. Branch circuits supplying mogul-base screw-shell lampholders in industrial establishments which are mounted nine feet from the floor and which do not have switch control as an integral part of the lampholder shall not exceed 250 volts to ground. True or false?

5. In office buildings, schools, stores, and industrial establishments, the voltage of branch circuits which supply only ballasts for electric discharge lamps in permanently installed fixtures which are mounted less than eight feet from the floor and which do not have manual switch control as an integral part of the fixture may exceed 150 volts to ground, but shall not exceed 300 volts to ground. True or false?

6. Infra-red heating lamps rated at 300 watts or less and used with lampholders of the medium-base uninsulated porcelain type in industrial occupancies:

(a) May not exceed 150 volts to ground.

(b) May not exceed 250 volts to ground.

(c) May be operated in series on circuits of more than 150 volts to ground provided the voltage rating of the lampholders is not less than the circuit voltage.

Which is correct: a? b? c?

7. Heavy-duty lampholders shall be deemed to include:

(a) Only lampholders rated at not less than 750 watts.

(b) Lampholders rated at over 750 watts and large bipin 660 watt electric discharge lampholders.

(c) Lampholders rated at not less than 750 watts and also admedium lampholders rated at 660 watts.

Which is correct: a? b? c?

8. In determining the load on the watts-per-square-foot basis, the floor area shall be computed from:

(a) The outside dimensions of the area involved and the number of floors but excluding open porches, garages in connection with dwelling occupancies, and unfinished spaces and unused spaces in dwellings unless adaptable for future use.

(b) The outside dimensions of the area involved but excluding only residential garages.

(c) The inside dimensions.

Which is correct: a? b? c?

9. Except those receptacles connected to the receptacle circuit or circuits for the small appliance load in kitchen, laundry, pantry, dining-room, and breakfast-room, all receptacle outlets of 15-ampere or less rating in dwelling occupancies:

(a) Must be considered as additional loads, and feeders and service conductors increased in size accordingly.

(b) Must be considered for load-computing purposes as not less than 5 amperes each.

(c) May be considered as outlets for general illumination, and no additional load need be included for such outlets.

Which is correct: a? b? c?

10. Demand factors permitted by the Code:

(a) Apply to service conductors, feeders, and branch circuits.

(b) Do not apply to branch circuits.

(c) Apply to branch circuits only.

Which is correct: a? b? c?

Answers will be found at the end of this article.

General Electric says:

"On the average, only 1 out of 100 G-E Lamps will burn out during the first year of service in a single shift operation."

Harold Kilburg, electrical contractor, says:

"Out of 5,150 G-E Lamps we installed a year ago, we've had to replace only 20. That's 1 out of 250!"

MR. KILBURG (center), president of Kil-Bar Electric Co., Chicago, inspects one of the G-E Lamps that has given such excellent service. Leo Carmody (left), wholesale agent salesman, and Larry King, G-E Lamp Salesman, worked together on this installation.

Cost of light is about 10 times the cost of the lamps. It is also the cost of the electricity used . . . and the cost of maintaining the system. If you specify lamps with unpredictable life, your customers will have lots of early burnouts. But G-E Lamps have a uniform life with few early burnouts. This means G-E Lamp users can schedule an economical group relamping program (replace all their lamps at the same time) and realize big savings in maintenance that far outweigh the little light left in the lamps. For full information on this way to improve your customers' lighting and save them money, too, write: General Electric Co., Large Lamp Dept. ES-28, Nela Park, Cleveland 12, Ohio.

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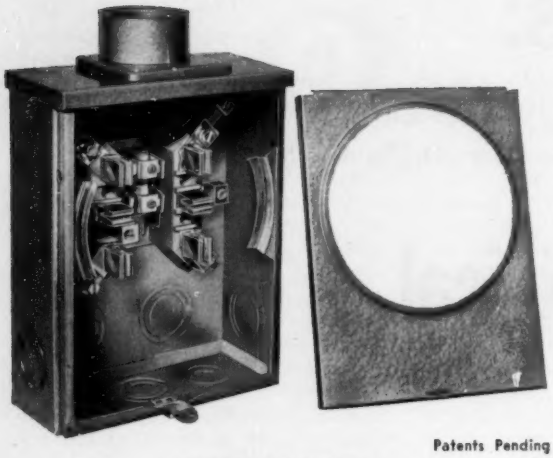

Patents Pending

CATALOG-WVL-0175A-2"
SIZE 10½" x 8" x 3⅝"
175 Ampere Capacity
3-Gang Ground, 5th and 6th Terminals
Added Line Terminals for connection to other sockets

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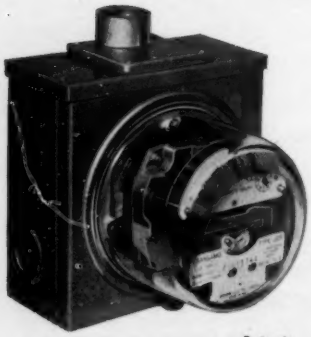

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Positive corrosion protection . . . the complete enclosure is provided with a nonabsorptive oxide film after fabrication, then finished in a hard, durable, baked-on grey Hammertone Enamel . . . unexcelled performance!

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. . . available in . . .

Light Duty
Medium Duty
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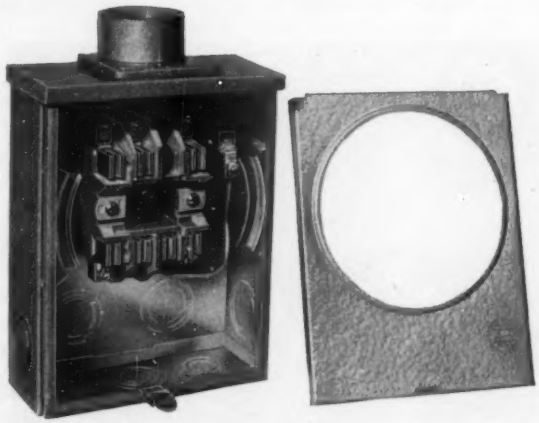
Patents Pending

CATALOG WVL-0150A-2"
Size 10½" x 8" x 3⅝"
Up to 150 Amp. Capacity



Patents Pending

CATALOG WVL-1007-A-2"
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Selection of metering method for kva demand totalization

By Robert M. Ballard
Division Meter Superintendent
Georgia Power Company
Rome, Georgia

◆ THE METERING of electric service supplied to large industrial plants sometimes involves the recorded totalization of the simultaneous kva demands of two or more services or substations. Every totalized metering installation has its engineering problems but the totalization of kva demands presents a unique combination of factors, each of which must be carefully considered if satisfactory operation, and economy of installation and maintenance are to be obtained.

Failure to use a fool-proof metering method for kva totalization could give meter readings that would not present a true picture of the combined loads being metered. Consideration must be given to obtaining other data needed such as the kw demand and the kwh consumption on each of the individual circuits that are totalized.

On each proposed installation one should make a thorough and detailed study of all factors involved before deciding upon the method of totalization that is to be used. The mis-application of an approved method could prove as costly as the use of an incorrect method. Correct application of approved methods and equipment will be accomplished only after careful analysis and planning are given to each installation.

Metering considerations

The characteristics of the circuits determine the number and size of instrument transformers that are to be used, but the method of metering and the types of meter used may be selected on the basis of economy, and the metered data desired. While the first consideration is for accuracy of metering, the cost of the installation and maintenance of the metering equipment must also be considered. The cost of a totalizing meter installation can be lessened if care is taken in selecting the type of meter or meters that are used. A comparative meter cost for the various applicable methods described is shown below.

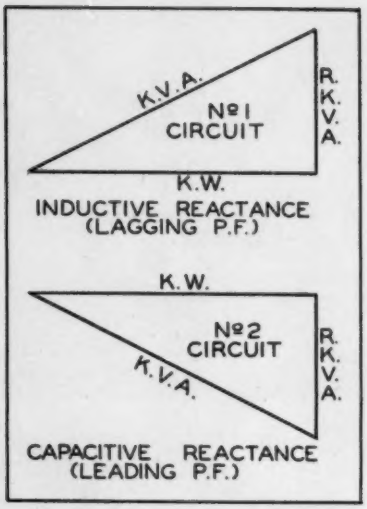
There are several accepted methods of totalizing kva demands of multiple stations or circuits. While each method has its own merits, it is necessary that one know the limitations of each method if metering errors are to be avoided. Due to the existence of these limitations it is important that careful consideration be given each proposed totalizing installation.

The selection of the correct method to use in totalizing kva demands is a task that can be accomplished only after determining the characteristics of each of the circuits to be metered. I refer to the following: voltage, phase, wire, power factor, total kva load, proximity of circuits to each other, number of circuits to be totalized, whether paralleled or isolated, and if paralleled, whether permanently or intermittently.

With as many factors to be considered and correlated to a com-

Comparative meter costs for methods described

Meter used	Cost	Alternate meter
RI-2	46% less than	RI-32
RI-2	56% less than	WRI
RI-3	33% less than	RI-38
RI-3	50% less than	WRI
RI-32	19% less than	WRI
RI-38	24% less than	WRI



Relation of kva and rkva on circuits having inductive and capacitive reactance, respectively.

and kva. This method requires the use of one kwh meter and one rkvah meter (with accessories) for each circuit being metered.

While this is a generally accepted method of totalization it has one limitation that restricts its application. It will not correctly totalize the kva demands of circuits whose power factors vary from leading to lagging or vice versa. This is due to the lack of a contact-equipped meter that will operate with forward and/or reverse rotation of the meter disc.

Since this method requires circuit characteristics that are not always obtainable, it is therefore applicable only where each metered circuit's power factor is (1) unity and/or lagging, or (2) unity and/or leading.

The accompanying power diagram shows the relation of kva and rkva on two equally loaded non-paralleled circuits, one of which has capacitive reactance and the other inductive reactance.

It is evident from the diagram that the totalized kw of the two circuits is equal to the arithmetical sum of the No. 1 kw plus the No. 2 kw. The totalized kva, however, is not obtained in the same manner. The totalized kva is dependent upon the totalized rkva. The totalized rkva is determined by adding vectorially the No. 1 rkva and the No. 2 rkva.

Since one circuit has an inductive reactance (lagging power factor), and the other circuit has an equal capacitive reactance (leading power factor), the two reactances will cancel each other. Therefore, there would be no rkva and the totalized loads of the two circuits would be at unity power factor and the totalized kva would be equal to the totalized kw.

It will be noted that in such a case the totalized kva of the two

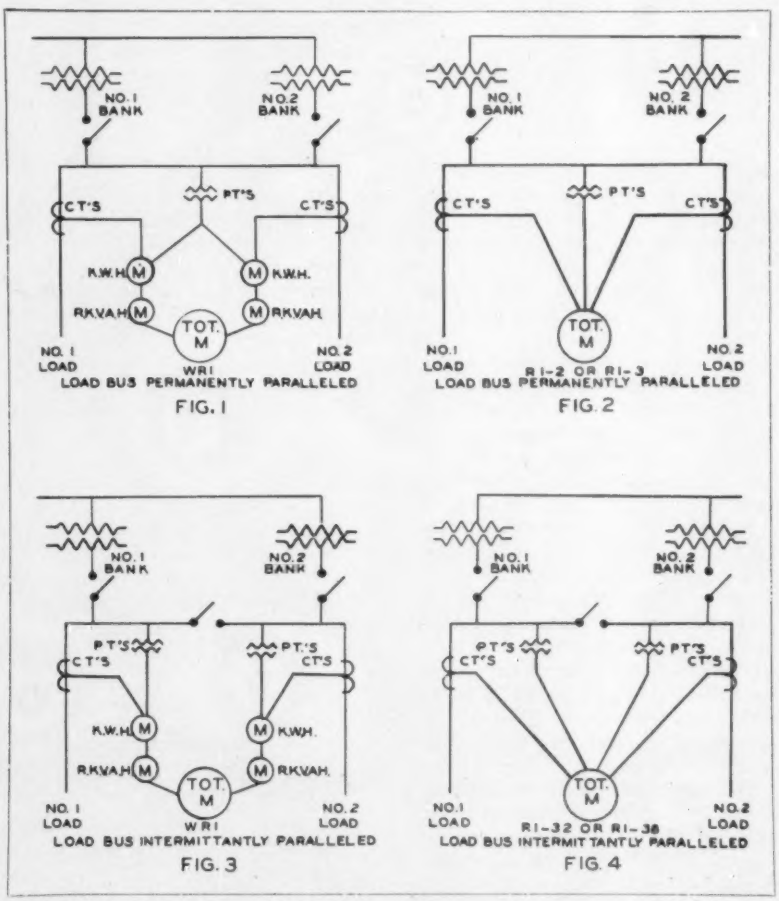
(Continued on page 101)

mon totalizing meter, one can appreciate the know-how that is required in making the correct selection of metering equipment. Also it is evident that a standard method could not well be adapted to meet the numerous variable conditions that generally exist among different installations where totalization of kva demand is required.

To assist in the selection and application of the totalizing method most adaptable to a particular set of circuit conditions, three methods are presented herewith, showing the limitations of each.

A detailed explanation of each of these methods is not given as it is not the intent of the writer to describe the theory involved in kva totalization but rather to point out the necessity of making proper applications of accepted methods. For the purpose of brevity this article deals primarily with the totalization of only two circuits. However, the methods described could be adapted to totalize a greater number of circuits.

Method No. 1 — Type WRI meter. (Impulse operated kva demand meter. See Fig. 1 and Fig. 3.) In this method the WRI meter is actuated by impulses received from contact-equipped kilowatthour meters and reactive kvah meters that are installed on the circuits to be totalized. These impulses are interpreted by the WRI meter so as to integrate totalized kwh and kvah and to record totalized kw



These diagrams illustrate the different methods discussed for metering totalization of kilovolt-ampere demand on two or more circuits.

Sudden-gas-pressure relay for transformers

By George Metry

◆ NUMEROUS protective devices have been developed for, and applied to, power transformers. A new addition to this field is the sudden-pressure relay (SPR).

This relay is designed to operate on sudden changes in gas pressure in the gas space of a gas-cushioned, liquid-insulated transformer. Its operation depends on the rate of pressure increase within the transformer housing. It is unaffected by static pressure or the slower changes in pressure which are normal to transformer operation.

On occurrence of a fault inside the transformer which will produce a moderate rate of increase in pressure, the relay closes (or opens) contacts which will sound an alarm or trip a circuit breaker.

The breakdown of transformer oil or other insulating liquid due to electric arcs results in the evolution of a gas. The amount of gas formed is a function of the arc energy, and the rate of pressure increase is determined by this and the volume of gas above the liquid.

The SPR relay consists of a pressure-sensitive device, a seal-in relay, equalizer, and test plug all mounted in a pressure-tight case.

The heart of the relay is the pressure-sensitive device composed of a diaphragm and a single-pole, double-throw switch (micro). It will operate on a differential in pressure across the diaphragm of about .33 pounds per sq in.

The operation of the pressure-sensitive device is governed by the equalizer. This is a non-corrosive pipe plug with a small orifice through it forming an opening between the transformer gas space and the relay case. Normal transformer operation over its entire pressure range can be maintained with equal protection by virtue of this device. The small opening acts to throttle any pressure change of a moderate or rapid rate of increase so as to effect a pressure differential. It is this pressure differential acting on the pressure device which initiates relay operation.

A differential pressure so produced is transient in nature. When caused by a low-current arc it may last for only a few cycles. The pressure-sensitive device will respond and close the alarm and trip circuits under such conditions.

The seal-in relay will close in ¼ cycle. It is electrically interlocked when it closes so alarm contacts are sealed upon operation.

A test plug in the case permits a simple test of the relay while the transformer is in service. When the transformer is operating at static pressure above ½ lb per sq in., the plug may be removed and the relay will operate. The relay may be re-set easily after the plug is replaced.

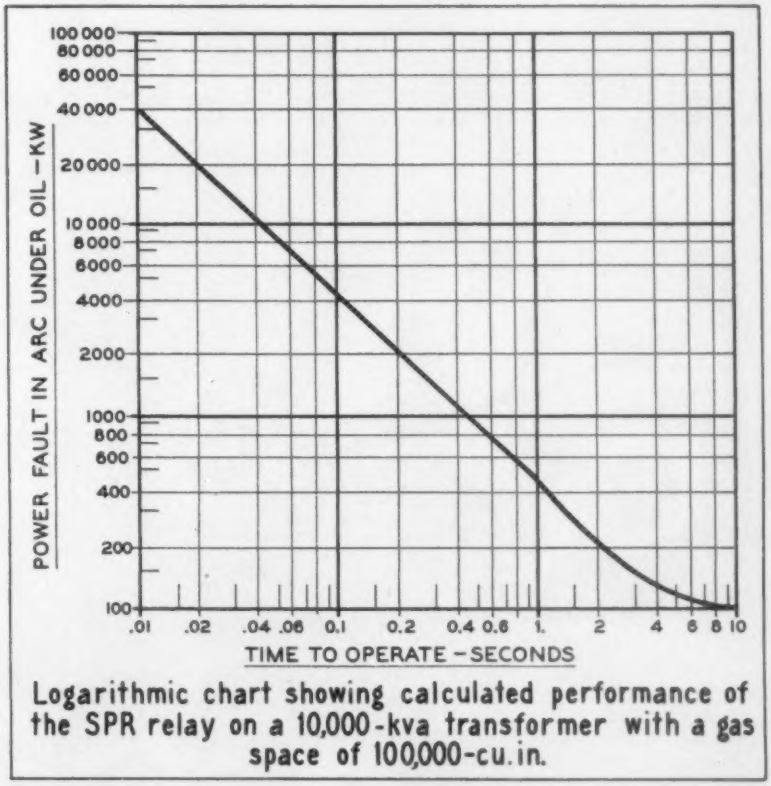
Resetting of the relay is accomplished by a manually-operated momentary *off* switch which accompanies the relay.

The SPR relay has been subjected to many tests which show that it performs as the designing engineers predicted. The results of these tests may be summed up as follows:

Its operation does not depend on the static pressure of the transformer tank but rather on the rate of rise in pressure above the static operating pressure of the transformer regardless of whether that pressure be positive or negative. The relay will respond to a rate of rise in pressure as low as ¼ psi per sec provided the total increase in pressure is at least ⅓ psi.

Disturbances which produce

(Continued on page 100)



Logarithmic chart showing calculated performance of the SPR relay on a 10,000-kva transformer with a gas space of 100,000-cu.in.

Sudden increases in gas pressure within a transformer case, such as would follow any arcing under oil, will cause the SPR relay to function and deenergize the transformer. Curve shows time required.

***The writer put this relay through a series of tests from which the chart was then calculated; it was issued to Westinghouse Electric Corp. and found correct.**

Combating contamination

By R. C. Webb
Operations Superintendent
Florida Power and Light Co.
Miami, Florida

◆ THE DAMAGE that results from having contamination on insulators acts as a constant prod to utility operating companies either to reduce the contamination or reduce the effect of it. From a practical operating viewpoint, the frequent end results of contaminated insulators are excessive flashovers and pole or crossarm burning.

Before considering the methods available for control of contamination, let us review the various fundamental factors involved.

Cause of burning and flashovers

The resistance across the surface of a contaminated insulator is considerably reduced by the presence of moisture. This reduced resistance results in higher leakage currents. In the case of non-bonded insulator pins or pole hardware, this leakage current—in passing over or through the wood or organic material that supports the insulators—may cause carbonization and arcing, and thus result in pole or crossarm burning.

Where the surface of an insulator becomes contaminated, very seldom is it evenly covered by the contaminant. The thickness and width of the contaminant will vary across the insulator surfaces, due to a number of reasons such as the physical design of the insulator petticoats, the physical position of the insulator, the direction and force of the winds and rains, and the physical shielding effects of nearby objects.

When rain or moisture falls upon this surface, the overall resistance is reduced and more leakage current flows. However, since the resistance varies across the surface, due to uneven contamination and probably uneven wetness, the IR drop or voltage gradient across the surface will vary considerably. In this manner, localized areas of high stress are developed. These localized high stress areas (usually the more protected and drier sections near the pin or between the petticoats) may flash across, resulting in still higher stress in other areas, and thus progressively initiating flashover of the entire insulator.

If the contaminant plus moisture that collected on the surface of the insulator would always present a uniform resistance across the surface, the problem of flashover would practically disappear, although the problem of leakage current would not be affected.

Common causes of contamination

Some of the common causes of contamination are: salt spray; cement dust; local soil dust; deposits from wood, grass, or muck fire; coal soot; and deposits from various industrial processes or gases.

The relative importance of these causes to a utility company is determined by its geographic location and the type of loads and industries within its area. In the above list, the first four causes are ranked in their relative order of importance to us.

There are a number of general ways of controlling contamination Four of these methods are: (1) through engineering and design; (2) by removal and replacement of contaminated insulators; (3) by

Three motorized high pressure washers are now in use to combat insulator contamination in FP&L area.

This closeup of nozzle shows construction details. Orifice of 16/64" and 350-550 psi pressure found best.

on high tension insulators

use of protective coatings on insulators; and (4) by use of high pressure water washing.

Engineering and design

The first thing that comes to mind is the very obvious idea of increasing the length of the leakage path over the insulator. In practically all cases, the "fog" type insulator has the common characteristic of longer than normal leakage distance over its surface.

In addition, the "fog" type insulator usually is designed to provide, insofar as practical, uniform leakage resistance across its surfaces when contaminated. A very common article that, to me, illustrates this design is the porcelain body of a 15 kv open dropout fuse cutout. The uniform accessibility of its surfaces is very obvious.

Where suspension insulators are used, the engineer can easily secure a longer leakage distance by adding additional discs. However, he is immediately confronted with the problem of securing long enough leakage distance to provide acceptable operating reliability for a reasonable increase in cost. What is considered to be aceptable operating reliability will vary with the company involved. The amount of additional leakage distance required to secure this acceptable reliability may vary considerably.

One writer on the subject points out that good reliability of service in contaminated areas could usually be obtained by using two inches or more of leakage distance to ground per kv. In our company, we have found this to be satisfactory. For example, the standard pin type insulator used on our 13.2/7.6 kv wye distribution system has a leakage distance of 12 inches, or approximately 1.57 inches per kv, phase to ground voltage. The pin type insulator, used in our "contaminated" or "salt spray" areas, has a leakage path of 21 inches, or approximately 2.75 inches per kv. This length of leakage distance has given us good results.

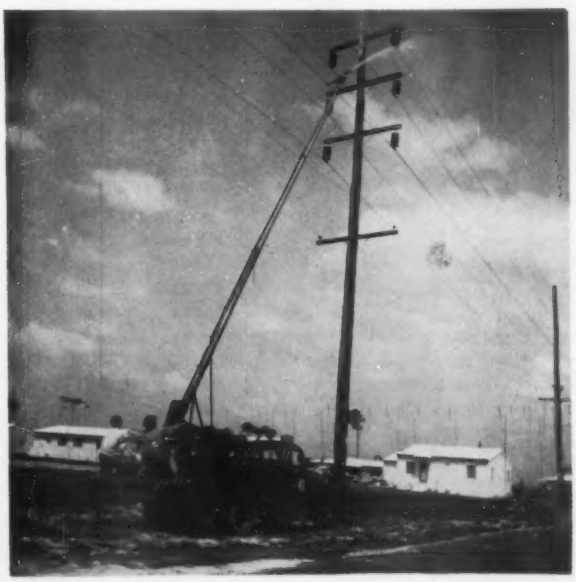
On our 69 kv transmission circuits, we originally used a four skirt, pin type, insulator with a leakage distance of approximately 41 inches, or 1.03 inches per kv. This insulator was not satisfactory in our contaminated area.

Eventually, a change was made to the use of a string of four 10 inch suspension insulators. This gave approximately 46 inches of leakage distance, or 1.15 inches per kv. As we continued to experience unsatisfactory operation, due to flashovers, the number was increased to a minimum of five 10 inch discs per string. This results in an approximate leakage distance of 57.5 inches, or 1.44 inches per kv.

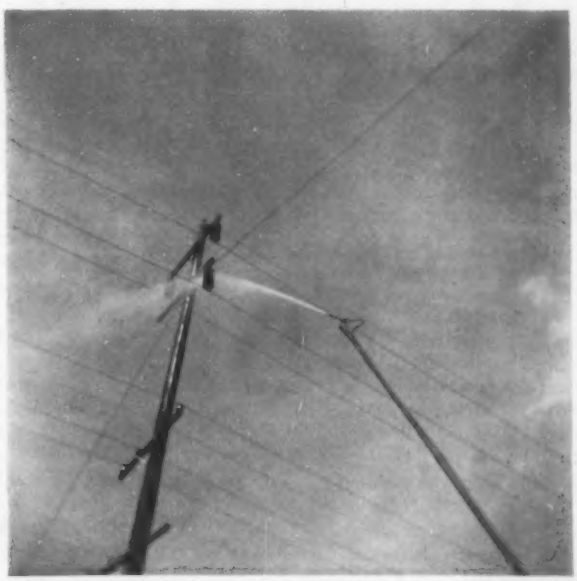
In our worst "salt spray" area of Miami, six 10 inch discs per string are used. This results in an approximate leakage distance of 69 inches, or 1.73 inches per kv. The six-disc string, together with high pressure washing, is now giving satisfactory operation.

69 kv pole hardware grounded

To eliminate pole and crossarm burning in our contaminated areas, the 69 kv pole hardware is grounded. In non-contaminated areas, we ring bond the crossarms rather than ground the pins. Although occasional arm burning has occurred during severe climatic conditions, we believe that the increased lightning impulse strength offsets these few occurrences.



Spray nozzle is operated at a distance of two feet or more from energized conductors on windward side.



City of Miami water can be used but water supplies with high mineral content will cause flashovers.

Still another means of controlling contamination, that is available to the engineer, is through close attention to the physical positioning of insulators and conductors so as to secure the minimum amount of collected contamination.

A recent local incident illustrates this point very well. Our Deauville Substation, located in Miami Beach, is completely enclosed within a large building. One 69 kv circuit, however, enters the building through roof bushings. Flashover trouble on these bushings was experienced a number of times. Since this substation building is exposed, and within four hundred feet of the ocean, these flashovers were blamed on salt spray contamination.

As a possible remedy, the use of both Insulcone and Dow Corning No. 5 compound was tried at this location. Neither compound, however, solved the problem.

While the practicability of installing a semi-automatic washing system for these bushings was being investigated, our substation supervisor, C. N. Whitmire, discovered the solution to this problem. This solution consisted of installing drip loops in the pulloff between the pole line and the bushings. These drip loops were installed just beyond the bushings. Since that time we have had no further flashover troubles from these bushings.

Apparently, salt deposits gradually accumulated along the surface of the conductor between the pulloff pole and the roof bushings. Since there was a considerable elevation change between the pulloff pole and the bushings, a drizzle or light rain would cause heavily contaminated water to trickle down the conductor and over the insulator petticoats, thus resulting in flashovers.

Removing contaminated insulators

Another method of controlling contamination is to replace periodically the contaminated insulators. After these insulators are removed, they are cleaned and reused, if possible. In many instances, they cannot be satisfactorily cleaned and must be disposed of. For the usual time intervals involved, this is an expensive method to use for controlling contamination.

We have had several locations near cement plants where such action was necessary, due to the inaccessibility of the pole to our insulator washer. However, it is hoped to eliminate such conditions in the future with the use of protective coatings.

Protective coatings

Before beginning on the subject of coatings, I would like to make reference to a report presented in New York on January 22, 1957, by H. N. Ekvall to the AIEE Lightning and Insulator Sub-Committee. This report, entitled "Survey of Insulator Treatment with Silicones and Other Compounds," was prepared from the data obtained from questionnaires returned from fifty-nine companies. The survey should prove helpful to everyone concerned with this approach to the contamination problem.

At a large cement plant, located just north of Daytona Beach, we received and are still receiving some interesting experiences with cement dust contamination. This plant is served by a 115/4.16 kv, 15,000 kva substation. The substation is served by two incoming lines, but nine spans away from the substation the two lines are merged into one.

Initially, no special precautions were taken to control contamination. However, after being in service for several years at 69 kv, the voltage was increased to 115 kv, and considerable trouble was experienced from excessive flashovers.

A service interruption to the cement plant was secured, and the insulators in the substation and on the nine-span dual incoming transmission lines were cleaned and replaced. At this time it was found that, in many instances, it was impossible to remove the cement coating from the insulators. In an effort to prevent this bonding action, the use of Insulcone was tried. This proved unsatisfactory. Johnson's Paste Wax was then tried and proved capable of preventing a bond.

The deposits of cement dust are now removed from the waxed substation insulator surfaces by hand cleaning with coarse steel wool, after which the insulators are rewaxed. The contaminated transmission line suspension insulators are removed and replaced with new waxed insulators.

The dirty insulators are later cleaned by convalescent personnel who are temperarily restricted to light physical duty. After being cleaned, the insulators are returned to stock. Now, every four months, a load reduction of one-half is secured for two days. During this time the insulators in the substation and on the two incoming thansmission lines are cleaned and rewaxed in progressive steps. During the most recent cleaning operation, a few selected sections were coated with Dow Corning #5 compound, so as to obtain a comparison with the use of Johnson's Wax.

High-pressure water washing

The cleaning or washing of insulators by hand is effective, but is slow and expensive. In order to utilize the washing method economically and effectively, it is desirable to employ some means of a high pressure washing machine.

In the early part of 1951, it was decided in our company that some rapid method of cleaning insulators on energized lines should be devised. Insofar as could be ascertained at that time, all methods of washing with high pressure water involved directing a stream of water by a man located in close proximity to the conductor and insulators.

The final design, as evolved by H. L. Allen, our automotive superintendent, resulted in the nozzle being placed at the end of an extendable, telescoping, fifty-five foot boom. The entire washing operation is controlled by an operator located on the bed of the truck.

Basically, this insulator washer consists of a suitable truck, a one-thousand gallon water tank, a five-hundred pound per square inch high pressure water pump driven by a six-cylinder engine, an extendable 55-foot telescoping boom that carries the spray nozzle, and the necessary apparatus for control of this equipment.

The washer is operated by a journeyman lineman and a winch truck operator. Under normal conditions, this two-man crew can wash and clean about 45 double circuit 69 kv poles per day. One refilling of the water tank will be required during the day's operation. As we have obtained very good results with this method of washing, we now have in service a total of three such washers.

We have found that a nozzle orifice of 16/64", and a pressure of 350-500 psi, provide the best operating conditions. Before using the washer, the operator grounds it

(Continued on page 98)

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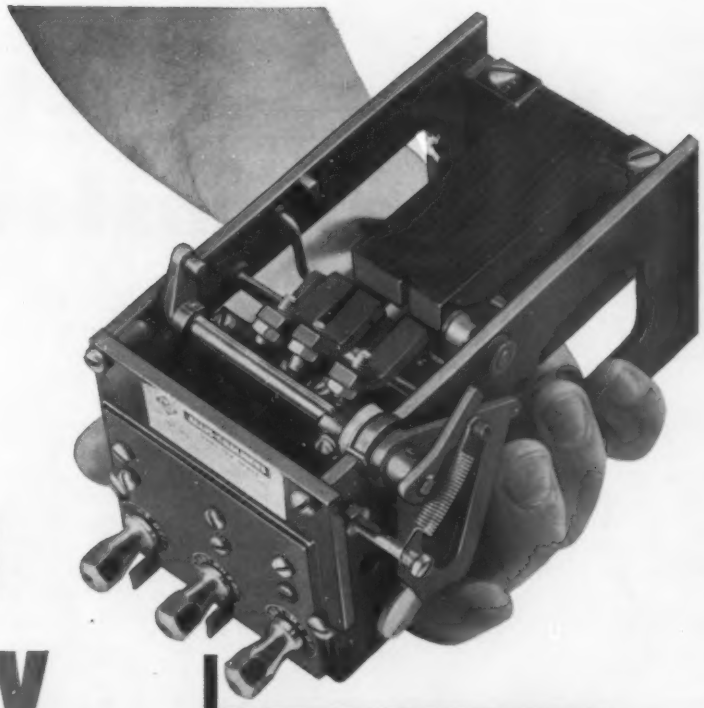

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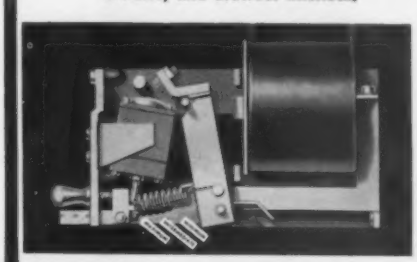
Operator inserting circuit breaker using positive-position pantograph. Note trip device accessibility, dead-front breaker, and drawout interlock.



Cutaway shows arrangement of components in Allis-Chalmers direct-acting series trip device. Note calibration scale below adjusting knobs and time band setting on armature extension.

A-5553

ALLIS-CHALMERS

the why and how of--

Autotransformers

By L. W. Schoenig

Manager of Sales
Transformer Department
Allis-Chalmers Manufacturing Co.

◆ MORE AND MORE autotransformers will be applied to power systems. They are unlike two-winding transformers in that many factors which have very little effect on the size of two-winding transformers materially affect the size and initial cost of autotransformers. It is important, therefore, to fully understand the advantages and disadvantages of this type of equipment. A thorough understanding can result in more transformer capacity per dollar, more efficient transformer usage, and transformer reliability equivalent to conventional transformer units.

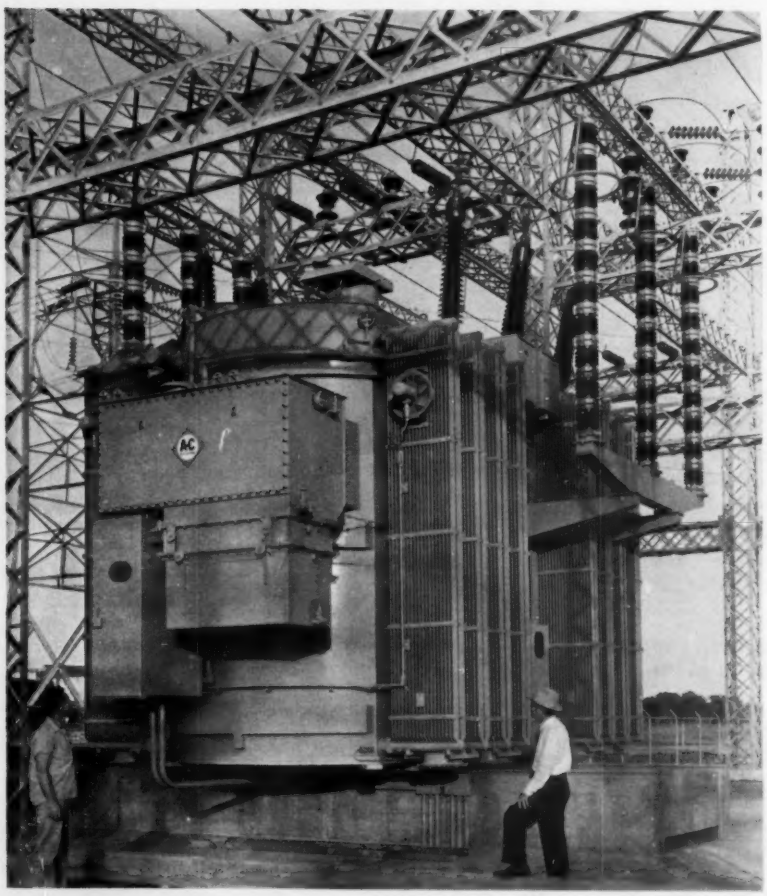
Autotransformers are not new. They are not something which was invented or discovered yesterday or the day before. They have been with us for a long time and will continue to be with us for a long time to come. Autotransformers are, for all practical purposes, as old as the transformer itself. In checking through the design archives, I found that potential starting transformers, as they were called, were designed, manufactured, and shipped as early as 1904 or 1905.

These units, which were used to permit reduced voltage starting of motors, were simple autotransformers. Even then, the advantages resulting from the autotransformers were realized. The use of autotransformers for power system application did not come into use until about ten years later.

Although many autotransformers are in use on power systems today, the acceptance was relatively slow. This may have been true because of reluctance to consider their use, preference for single winding transformers, or because of limited application. Today the acceptance is almost universal; preference trends toward the use of autotransformers and applications are more prevalent.

Why are more and more autotransformers being used today? This question can basically be answered in one word—economics. These economies are evidenced in lower initial cost, lower losses, less weight, and smaller space requirements.

The advantages of autotransformers over conventional two or three-winding units are many. However, there are a few disadvantages that should be carefully investigated before considering autotransformers for any particular job.



Transmission and distribution economics is bringing about the use of more autotransformers on electric utility systems. This 132/66 kv unit was installed recently by Houston Power and Light Company for system interconnection. Unit is rated 50,000/66,667/83,333 kva.

Construction differences

An explanation of the difference between two-winding and autotransformers may assist in obtaining a better understanding of autotransformers and their characteristics. The various circuits of a two- or three-winding transformer are

coupled only magnetically, whereas in an autotransformer the auto circuits are electrically connected. Diagrams for the two types of transformers are shown in Figures 1 and 2.

The two-winding transformer has a high voltage and a low voltage winding wound on the same core. An autotransformer has one winding which is common to both high voltage and low voltage circuits, a winding which is in series with the high voltage circuits, and usually a tertiary winding.

The tertiary winding is usually delta connected to provide a path for third harmonic magnetizing current. It is used to stabilize the neutral and protect the transformer under short circuits.

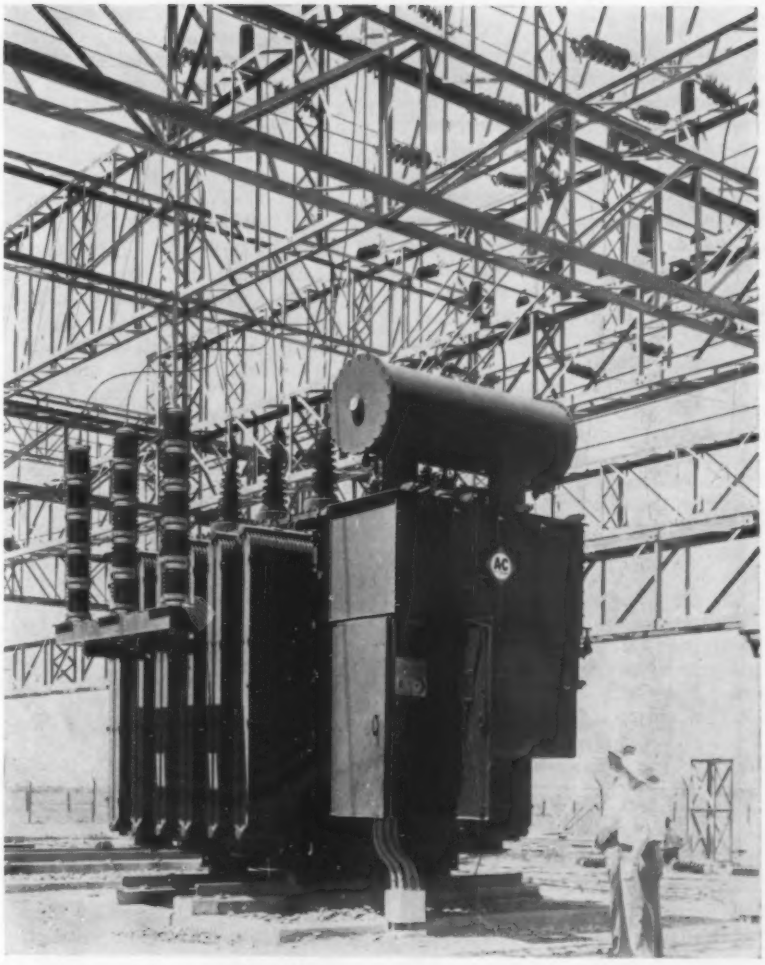
To obtain sufficient thermal and mechanical strength under fault conditions, the usual minimum capacity of a tertiary winding is 35 per cent of the kva size of the larger of either the series or common windings. This capacity is based on actual kva size, not circuit windings. The tertiary can also be used to supply loads, in which case its capacity must be designed in accordance with system needs.

Autotransformers are frequently used for loop circuits or interconnecting systems. This practical connection is a more efficient means of tying systems together than by doing so with two-winding transformers, because the ratio of the electrical size of the autotransformer to the electrical size of the two-winding transformer is equal to (HV-LV)/HV.

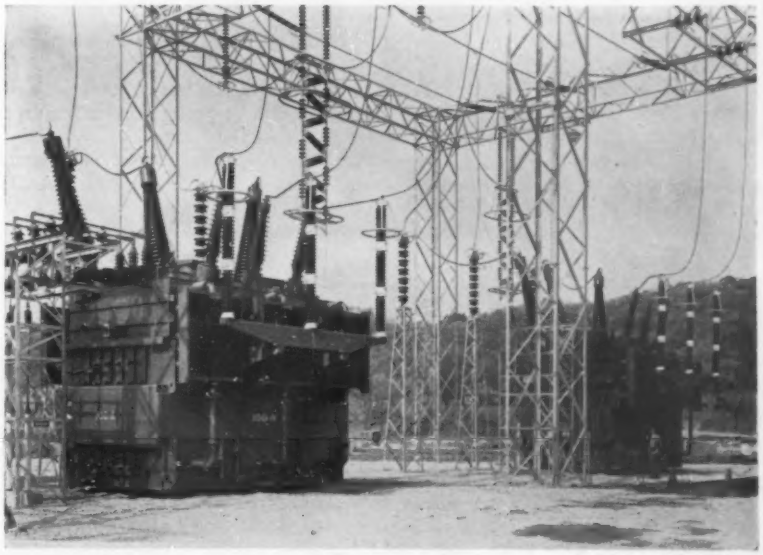
Saving in size

The size of the autotransformer will therefore be considerably smaller than the comparable two-winding transformer. Usually, if the ratio of high to low voltage is not too great, the autotransformer will have lower impedance, lower exciting current, lower core and copper losses, and higher efficiency than the two-winding transformer.

Lower impedance is a disadvantage under short circuit conditions, but usually there is sufficient impedance in the system to limit short circuit currents to a value of 25 times normal or less. All transformers, both auto and two-winding, designed to meet ASA standards, will withstand short circuit stresses of at least 25 times normal for two seconds if the impedance of the autotransformer has the advantage of contributing to better regulation.



This three-phase 30,000-kva autotransformer was installed on the Gulf States Utilities Company's system at Port Arthur, Texas.



Indiana-Kentucky Electric Corporation installed these two 125,000-kva 330,000/135,000/13,800-volt units at its Clifty Creek plant subdivision for sleet melting and interconnecting tie service.

Saving in cost

A comparison of the first cost as well as the electrical and mechanical characteristics of a conventional and an autotransformer, both rated 25,000 kva, self cooled, three phase, 138 kv Grd 6 to 69 kv Grd Y, and the influence of a tertiary for harmonics are shown in Table 1.

The table shows the initial cost of the autotransformer to be about 65 per cent of the conventional type. An even greater percentage savings is apparent when losses are considered. Autotransformer losses are only slightly more than half of those in the conventional transformer. In most cases weight and dimensions are not too important; however, the use of autotransformers will effect a reduction of about 30 per cent.

The weight advantage of autotransformers becomes a major consideration in very large kva units. It is possible to manufacture and ship autotransformers having much larger through kva capacity than conventional transformers.

Feeder voltage regulators are probably the most common type of autotransformer. The fact that they are autotransformers is often overlooked by many people. This application is very practical and efficient since in most units the ratio of high voltage or low voltage is fairly close to unity.

Ratios

Until recently, few autotransformers were used when the ratio of high voltage to low voltage exceeded about two to one. Desirable applications are 230 to 115 kv, 138 to 115 kv, and so forth. Occasionally autotransformers were used for 161 to 69 kv, but this was considered by many to be about the maximum ratio which was desirable.

Today the two to one ratio of high voltage to low voltage is not considered to be a limitation. Many autotransformers having ratios of two and a half to one and higher are in use. Spectacular examples of this are the 345/138 autotransformers now in use.

Application

Autotransformers can be economically applied to solidly grounded systems. It is possible, when the neutral is solidly grounded, to use reduced insulation, resulting in smaller, more efficient, lower initial cost transformers. If the neutral of the autotransformer is not solidly grounded, special attention must be given to the design of the common winding.

It is the usual practice in this case to insulate the common or low voltage winding with the same class insulation as the high. If the neutral is grounded through an impedance or insulated for more than solid grounding (15 kv class) it is normally designed with the same insulation class as the low voltage line.

The principal advantages of using autotransformers can be obtained only with Y-connected units. Delta-connected autotransformers result in units having larger equivalent ratings, no neutral available for grounding or loading, and full insulation on both series and common windings. For these reasons, delta-connected autotransformers are not commonly used on high voltage power systems.

To insure safe and stable operation, three major items must be considered when evaluating a job for possible application of autotransformers:

1. Grounds on power systems and their effect on line-to-neutral voltage.
2. Third harmonic problems and their effect on stability and interference.
3. Switching and impulse surges and their effect on insulation.

The voltage stresses resulting from grounds on power systems can be limited to safe values by grounding the neutral of the autotransformer. The third harmonic problems can best be solved by including a delta-connected tertiary in the autotransformer.

The delta winding provides a path for third harmonic currents, thereby eliminating telephone interferences. The delta winding also stabilizes the neutral during fault currents. The capacity of the delta tertiary need be only 2 or 3 per cent of the autotransformer capacity to handle the third harmonic currents.

However, to stabilize the neutral and protect itself under fault conditions, the rating of the tertiary must be 35 per cent of the transformer rating. Transient voltages resulting from switching or impulse can best be limited to safe values by properly applied lightning arresters.

Autotransformers, like multi-winding units, can be operated step up or step down. The current distribution is shown in Fig. 3 for step-down operation and Fig. 4 for step-up operation. When a load is taken from the tertiary, the high-to-low capacity depends on the tertiary load and the type of operation (step down or step up). The current distribution for step-down and step-up operation is shown in Figures 5 and 6, respectively.

Effect of taps

An important factor that is frequently overlooked in specifying autotransformers is the effect of taps on the equivalent kva size of the unit. The addition or omission of no-load taps in a two- or three-

TABLE 1

	AUTOTRANSFORMER		CONVENTIONAL TRANSFORMER	
	NO TERTIARY	WITH TERTIARY	NO TERTIARY	WITH TERTIARY
Initial Cost (%)	100	108	153	165
Winding Rating (kva)	13,128	15,540	25,000	29,375
Core Loss (kw)	40	48	50	60
Total Loss (kw)	108	116	200	210
Impedance HV to LV (%)	6	6	11	11
Regulation HV to LV at 0.8 pf (%)	4.0	4.0	7.5	7.5
Total Weight (lb)	145,000	155,000	205,000	220,000
Floor Space (inches)	180 x 170	190 x 170	200 x 180	210 x 180

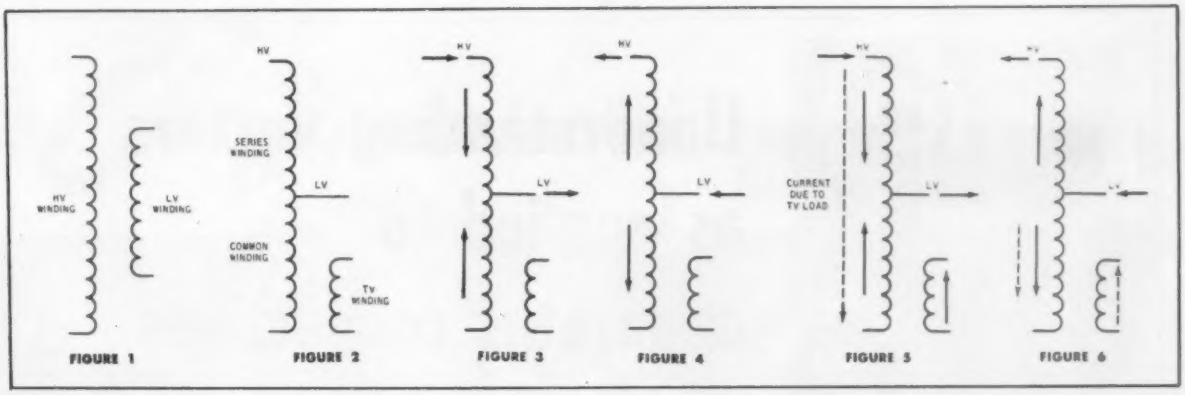


FIGURE 1 FIGURE 2 FIGURE 3 FIGURE 4 FIGURE 5 FIGURE 6

winding transformer has comparatively little effect on its size. The addition of no-load taps in an autotransformer, however, materially affects its size. This can be illustrated by using as an example, a 161/138 kv autotransformer.

The addition of one 5% full capacity tap above and below normal in the high voltage winding increases the equivalent kva rating by 35%. Taps in the low voltage or common winding frequently have more effect on the size of the autotransformer than high voltage taps.

In our example, the addition of one 5% full capacity tap above and below normal in the low voltage or common winding increases the equivalent kva rating by approximately 37%. If the autotransformer in our example was supplied with one 5% full capacity tap above and below normal impedance both the high voltage and the low voltage or common windings the equivalent kva size of the unit would be increased about 75%.

Needless to say, when writing specifications for our transformers, the tap requirements should be given very careful study. If taps are not dictated by system requirements, they should not be specified simply because of the old accepted idea that all transformers should have taps.

In autotransformers with a ratio of high voltage to low voltage of near unity, special thought should be given to the elimination of high voltage taps. Taps in these cases can materially complicate the design and affect the initial cost.

As an example, four 2½% taps below 161 kv on a 161/138 kv autotransformer tap out approximately 70% of the series winding. Special design considerations must be used in this case.

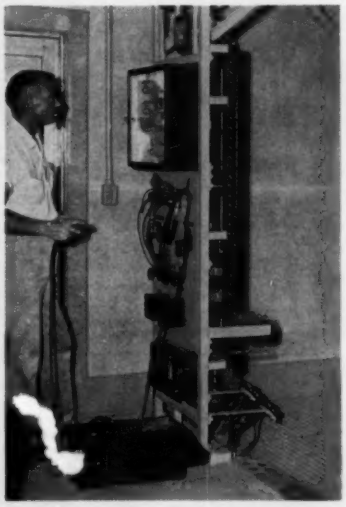
Helicopters set poles in difficult terrain

A SPECIALLY equipped Sikorsky helicopter is being utilized by a western utility company to set poles in position in rugged mountainous areas. The helicopter was built for this purpose.

The project was the product of the problem of setting up a two-mile power line up a mountain slope. The poles are dropped in prepared holes. About 60 poles were so set up in this operation, covering the two miles of the slope. All of the poles were fully loaded and rigged with ropes to the helicopter by hook.

The helicopter picked up the poles at a depot and then flew them to pole sites. One pole was set into position every three minutes.

The operation required a little less than two days. Without the helicopter, it was estimated that this operation would have required at least two months.



Understanding vectors as applied to apparatus connections

By E. B. Henry
Relay Engineer, Gulf Power Company
Pensacola, Fla.

Part 4

Wattmeter connections

Illustrations of meter or relay connections require the use of vector diagrams in a way that brings to the front the matter of vector notation and the meaning attached to them. With regard to these, there are different viewpoints among both engineers and academicians. It is probably not a matter of great moment since any of the methods in general use will get correct results if correctly applied. It is only that a newcomer to the field may be slower in his grasp of these mental tools, due to disagreement among his elders, and the more rapid the grasp of the newcomer, the better for all concerned.

Comparisons of several methods of electrical vector notation were set forth, sometime ago, in a published article[1] in which a standard was recommended by the authors; later an A.I.E.E. transactions paper[2] gave a number of diagrammatic ilustrations in support of the same point of view. It is a good assumption that this voltage drop viewpoint is that of many engineers, but since it is not held by all, it is being further advocated here (Fig. 14 and Fig. 15).

In the vector diagram of Fig. 14, I_a, I_b, I_c, indicate current flow from the source to the load. E_{an}, E_{bn}, E_{cn}, indicate voltage drops through the meter in phase with the corresponding current. The plus signs on the meter represent terminals of the same polarity of the meter which means that in-phase voltages and currents applied to these terminals produce motion in the forward direction; as is well known this motion will be produced just so long as the displacement between the voltage and current is less than ninety degrees in either direction; further the phase sequence makes no difference in the case of the wattmeter or watthour meter; a glance at the vector diagram will show that this is necessarily the case, since the current may be displaced in either direction, as it approaches its ultimate limit of 90°, without causing a reversal of rotation, since the cosine remains positive.

In Fig. 15 is shown the ordinary two-element meter connections, familiar to all. Included is a vector diagram illustrating the connections. The meter is supplied with current from two current transformers and voltage from two po-

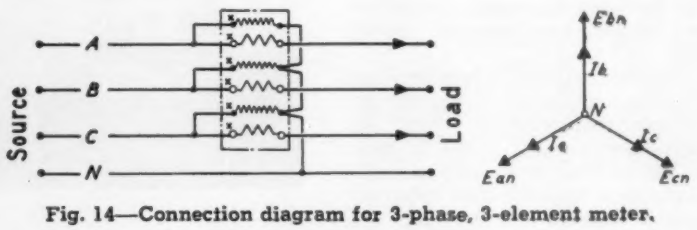


Fig. 14—Connection diagram for 3-phase, 3-element meter.

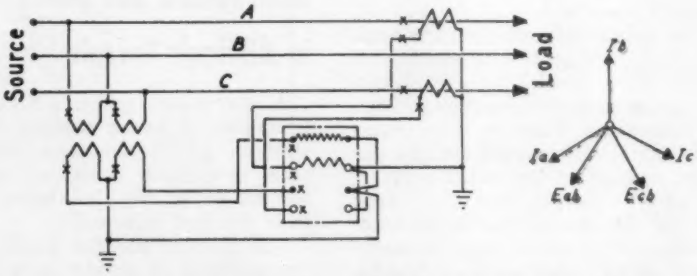
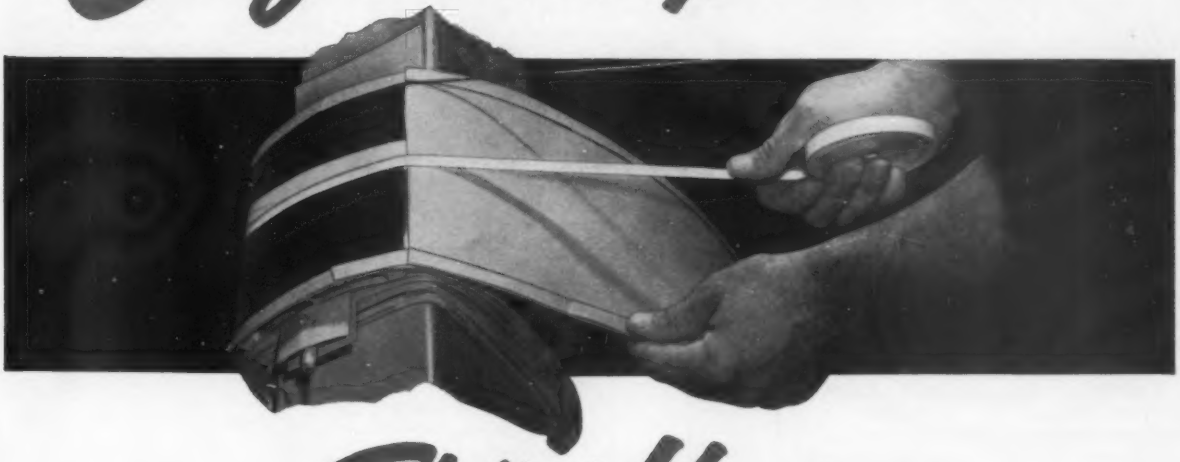


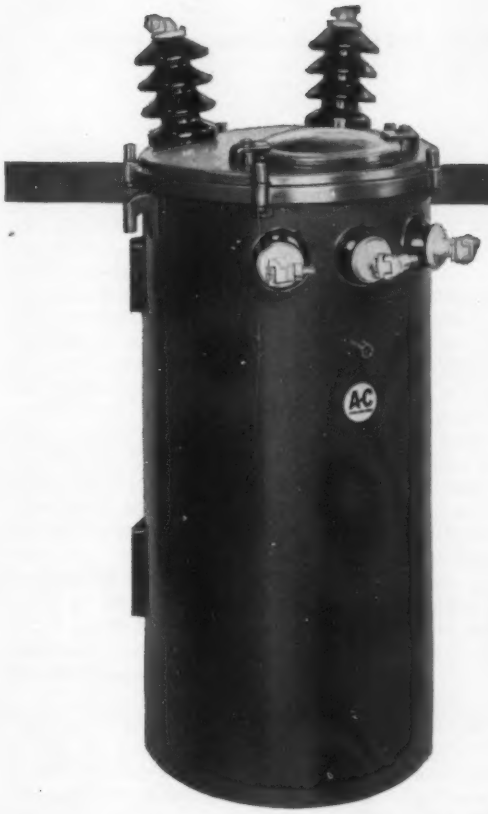
Fig. 15—Connection diagram for 3-phase, 3-wire, 2-element meter.

1. "Voltage Notation Conventions" by Myril B. Reed and W. A. Lewis *Electrical Engineering*, January 1948.
2. "Simplification of A-C Voltage Vector Systems" by W. K. Sonneman; AIEE Paper No. 54-314.

Craftsmanship at Allis-Chalmers



Skilled Hands build long life and outstanding performance into Allis-Chalmers distribution transformers



Start with advanced research and development. Set high standards in design, engineering and manufacture. Work with only the best materials and facilities. Crown your efforts with industry's most rigid quality control program. Give these ingredients to master-craftsmen. This is what Allis-Chalmers does to build long life and top performance into a transformer.

At Allis-Chalmers, craftsmanship penetrates every operation—from the laboratory to the shipping platform. It's your assurance of always getting the maximum transformer value.

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A-5486

tential transformers. The connections shown are not likely to be questioned, but there are some who might see a discreptancy in the order of the voltage subscripts since the arrowheads may seem to be pointing in the wrong direction to indicate a voltage drop from A to B and C to B.

As a discreptancy, this becomes more apparent than real when one notes that it is the logical outcome of a usual end result, the application of the correct potential to equipment terminals. The plus signs indicate, for each pair of coils, terminals at which the current and the applied voltage must be less than ninety degrees apart in order to produce motion in the forward direction. As a consequence this is equally true of the unmarked terminals.

Currents in the conductors A and C flow through the wattmeter to the load, their angular positions being shown by the vector diagram. The arrowheads of the voltage vectors and the subscripts, ab and cb, indicate (1) that as the current, I_a, flows through its current coil from the source side to the load side, a voltage drop tends to cause a current to flow from A to B in the corresponding potential coil, thirty degrees leading the current I_a, and (2) that as the current I_c flows through its current coil from the source side to the load side a voltage drop tends to cause a current to flow from C to B, through the corresponding potential coil, thirty degrees lagging the current, I_c.

Deviations from these angular positions are not brought about by the tendency of the voltage drop. An apparent discrepancy in direction appears in the voltage drop viewpoint only when one attempts to make the vector diagram stand alone.

Varmeter connections

For orientation turn back to the familiar vector diagram and connections for a three-element watthour meter at unity power factor as illustrated by Fig. 14. The problem now is to make the watthour meter register as a varhour meter. It is obvious from the vector diagram of Fig. 14 that the 90° relation can be obtained by connecting the currents as for a watthour meter and applying potential from the other two phase wires. It is also obvious that the voltage so applied is about 1¾ times the voltage required for correct registration. The usual method is the introduction of an auto transformer to reduce the voltage to a value commensurate with that used with a watthour meter. This method is illustrated in Fig. 16.

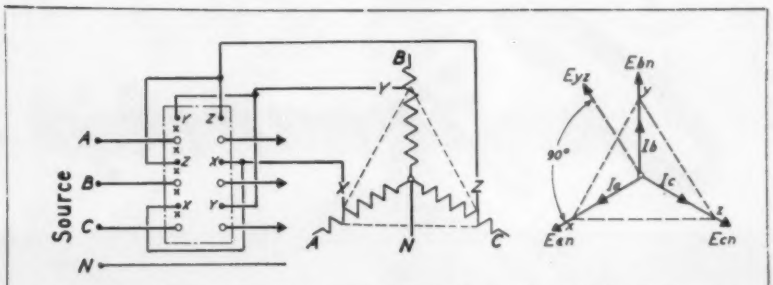


Fig. 16—Connection diagram and vector relationship for 3-phase, 4-wire varmeter or varhourmeter.

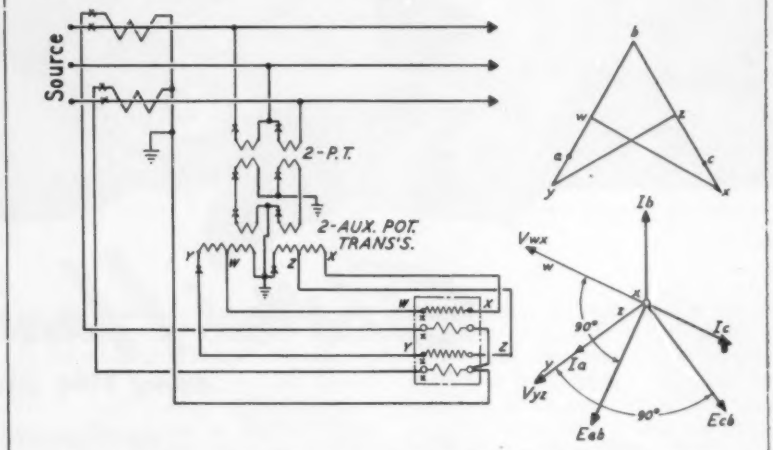


Fig. 17—Connection diagram and vector relationship for 3-phase, 3-wire, 2-element varmeter.

Since the vector diagram of the auto transformer is the same as that of the potential transformers required for the three-element watthour meter, points X, Y, Z will be placed on the same diagram and dotted lines drawn to indicate the voltages to be used. In actual practice an auto transformer is usually interposed between the potential transformers and the varmeter and the taps X, Y, Z are reduced voltage taps for use with the varmeter. The requisite 90° relation can be ascertained at a glance; now the question of the correct direction arises.

First, the current coils are connected as for a watthour meter. The voltage connections can now be considered in turn; beginning with the voltage coil corresponding to the current coil supplied with the current I_a, the voltage on the opposite side of the triangle must be the associated voltage. To ascertain direction, refer to previous discussion and note that the flow of reactive is toward an inductive load for which the meter movement must be in the direction of increasing registration for an integrating meter and upscale (to the right) for an indicating or recording meter. So the vector E_{yz} is selected and moved parallel to itself until one end is at the origin, its position being such that it lags the wattmeter vector E_{ab} by 90° as shown by the broken line. This means that the lead y is to be connected to the meter terminal of the same polarity as the current terminal to which I_a is connected and the terminal Z is to be connected to the other end of the same potential coil. The other potential coil connections can be ascertained in the same manner.

As an aid to interpreting the vector diagram, it may be noted that the point to be paired with the current polarity terminal lies on the vector that lags the current vector. Also as the current lags its unity power factor position, the

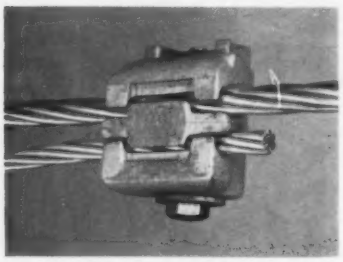
(Continued on page 100)

Notes on new utility equipment

Interlocked contact bodies speed connector installation

ONE-PIECE DGA connectors for fast installation, high conductivity and greater durability are announced by Anderson Electric Corp., P. O. Box 2151, Birmingham, Ala.

The DGA connector comes in seven sizes, announced E. C. Bitzer, vice-president. Its one-piece construction makes possible a simple, three-step installation; hook on the main, insert



the tap and tighten. A center cover-all spacer of soft, pure aluminum is supplied with the four larger sizes.

This spacer assures additional high conductivity contact with individual strands, and massive construction insures cool, long-life contacts, he explained. The spacer is extended and can easily be picked up for tap insertion, whether the DGA is applied on "hot" or "dead" wires.

Installation and contact efficiency are further improved by interlocked contact bodies to maintain main and tap groove alignment. The new connectors are also chemically cleaned and pre-inhibited to reduce contact resistance and protect from corrosion without greasiness or tackiness, Mr. Bitzer pointed out.

Anderson also announced production of a new DGD bolted deadend clamp, designed for light duty pole and house service drops. The one-piece clamp insures fast, simple installation and a wave seat in the clamp body affords greater holding power.

For additional data, ask for item U-201, using the coupon on page 99.

Elevating structure for voltage regulators

AN ADJUSTABLE elevating structure, offered by Line Material Industries, McGraw-Edison Co., 700 W. Michigan, Milwaukee 1, Wis., facilitates substation installation of RSD voltage regulators.

It is vertically adjustable in three-inch increments to produce mounting heights between 36 and 48 inches.

The platform channels are also laterally adjustable to accommodate all sizes of L-M regulators.

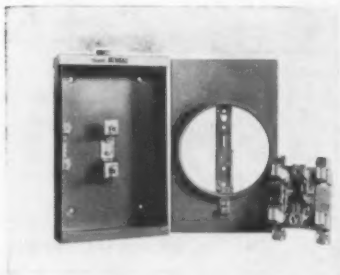
According to N. K. Delaney, product manager for capacitors and regulators, an RA1M elevating structure offers an economical means for achieving the regulator bushing terminal heights specified by local code. Prefabricated in the factory, a structure can be assembled and adjusted rapidly with savings of time and labor. Each structure is hot-dip galvanized for corrosion resistance.

For additional data, ask for item U-202, using the coupon on page 99.

Manual by-pass saves room, simplifies meter removals

A MANUAL BY-PASS designed to meet today's needs for a safe, dependable, positive means of furnishing continuous service during meter removals and replacement has been announced by Murray Manufacturing Corp., 1250 Atlantic Ave., Brooklyn 16, N. Y.

The by-pass has several advantages over older types. Designed to fit presently acceptable size troughs, the



unit eliminates the need for large, unattractive cabinets with extra covers, blocks, and seals.

Unauthorized current diversion is unlikely since the device cannot be operated without first removing seal and meter ring. No special jumpers are required; meterman needs only screwdriver to engage and disengage by-pass.

Interior assemblies complete with by-pass and cover can be purchased separately and are interchangeable with covers and interiors of devices having no by-pass means. Unit is available in a variety of socket meter troughs.

For additional data, ask for item U-203, using the coupon on page 99.

250 kva pole-mounted distribution transformer

A NEW 250 KVA pole-mounted distribution transformer is now available from the Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa. The new unit extends ratings in the line of distribution transformers from 167 kva, largest units previously manufactured, and is especially suited for applications in congested areas.

The new transformer weighs approximately 1700 pounds, about 300 pounds heavier than the 167 kva

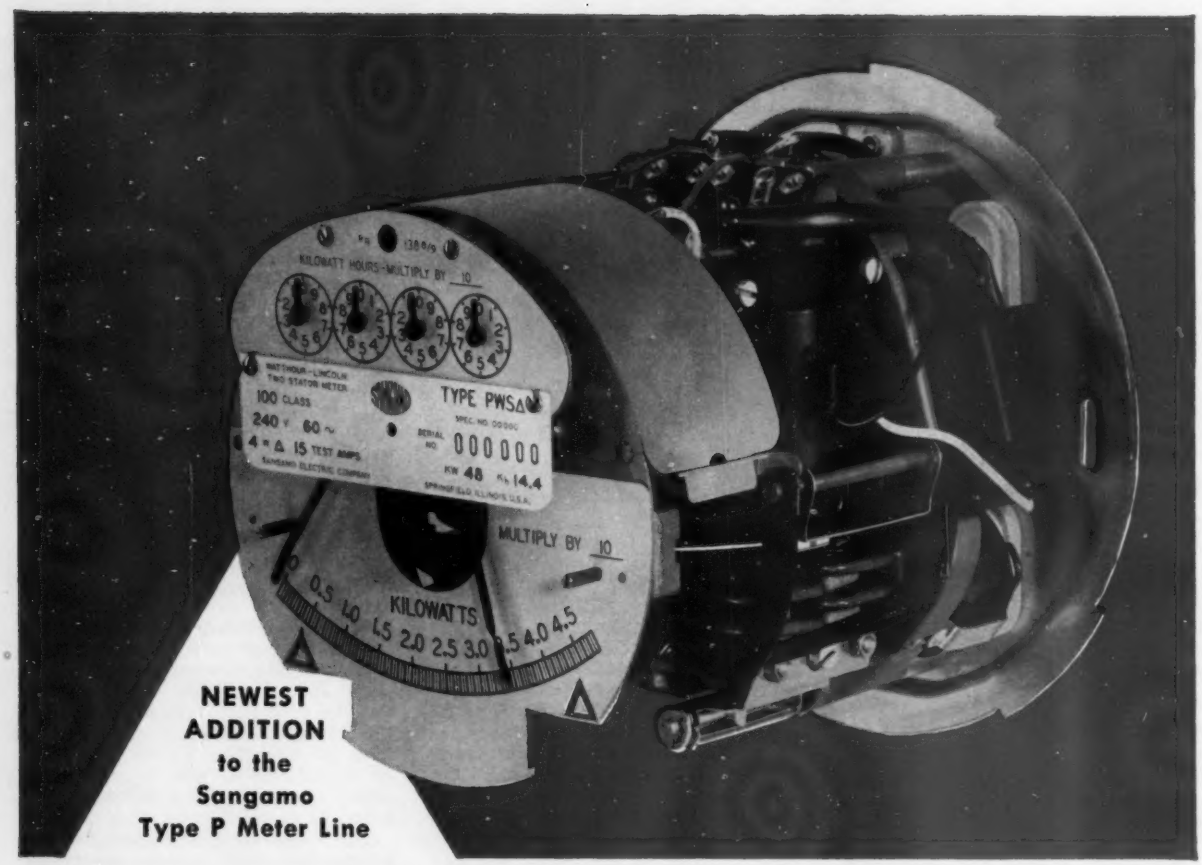
units and well below standard weight limits for pole mounting.

The electrical performance of the 250 kva transformer is comparable to the 167 kva unit and lower ratings.

For additional data, ask for item U-204, using the coupon on page 99.

Unit facilitates testing of complex relay equipment

A NEW DEVICE, available from the Multi-Amp Corp., 465 Lehigh Ave., Union, New Jersey, provides phase angle meter, voltmeter and appro-


KILOWATT HOURS-MULTIPLY BY 10
TYPE PWSΔ
100 CLASS
240 V 60 ~
4 w Δ 15 TEST AMPS
SANGAMO ELECTRIC COMPANY
SPRINGFIELD ILLINOIS U.S.A.
MULTIPLY BY 10
KILOWATTS
0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5
NEWEST ADDITION to the Sangamo Type P Meter Line

Sangamo Type PWSΔ—compact polyphase Combination Watthour and Lincoln Demand Meter

NOW... for convenient, dependable demand measurement of all polyphase circuits... Sangamo presents the Type PWSΔ combination watthour/thermal-demand meter.

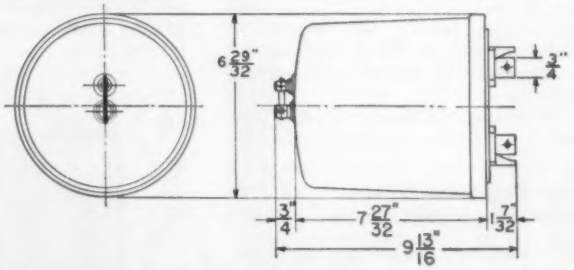
ALL NEW DESIGN combines the features of Sangamo's new two-stator four-wire delta meter with the time-proven Lincoln watt demand meter. Both the watthour meter and the demand meter are complete units that function independently on entirely separate circuits.

COMPACT CIRCULAR CONSTRUCTION ... USES CONVENTIONAL ROUND COVER

The Type PWSΔ is a compact assembly that is mounted on a standard circular base plate, and is enclosed by a conventional round glass cover. The PWSΔ is built like—and looks like—the popular Sangamo Type J2TS.

EASY TO READ—EASY TO ADJUST. Kilowatthour dials are never obstructed by the demand pointers. Simple and readily accessible adjustments are provided for both demand and watthour meters.

EASY TO MAINTAIN. All Lincoln secondary leads are solder-connected at convenient junction blocks. Register assembly can be removed without disturbing soldered connections for easy access to watthour meter components. Watthour meter—including bearing system—is *guaranteed for life.*



THE COMPLETE LINE OF SANGAMO TYPE P METERS WILL HANDLE ALL POLYPHASE MEASUREMENT

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WROUGHT IRON CONDUIT* for highly corrosive installations

ELECTRICALLY APPROVED

YOU GET A THREE-WAY SAFEGUARD AGAINST CORROSION

1. High Quality Wrought Iron Pipe

The fibrous structure of wrought iron confines corrosion to the surface of the conduit . . . makes wrought iron superior to any other conduit for extreme corrosive areas.

2. Zinc Protection Through Sherardizing

The National Electric Sherardizing process of galvanizing actually alloys zinc dust with the wrought iron conduit. This uniform zinc-wrought iron alloy protection is permanently bonded to the walls. NE Wrought Iron Conduit is Sherardized *after* the threads are cut to assure complete end-to-end protection for the base metal.

3. Interior and Exterior Protection with New Formula MVC-1

National Electric coats its wrought iron Sherardized conduit with an exclusive new acid-resistant vinyl enamel —MVC-1, a Modified Vinyl Copolymer. MVC-1 will not flake or chip when bent and is extremely resistant to high temperatures. Inside the conduit it provides a smooth finish for fast, easy fishing of conductors.

*National Electric Wrought Iron Conduit is processed from wrought iron pipe manufactured by A. M. Byers Company, Pittsburgh, Pennsylvania. A. M. Byers is the world's largest producer of wrought iron and the only manufacturer of wrought iron pipe. Where corrosion is a serious and costly factor, wrought iron has proved to have superior durability over other ferrous metals.

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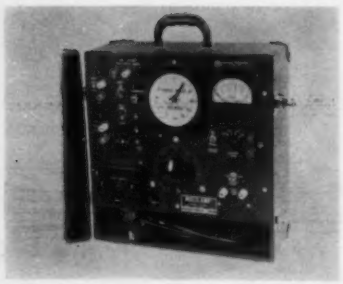


priate connections in one compact box. It is used as a convenient junction point when an output, variable is phase and magnitude, is required, in conjunction with a phase shifter and other equipment.

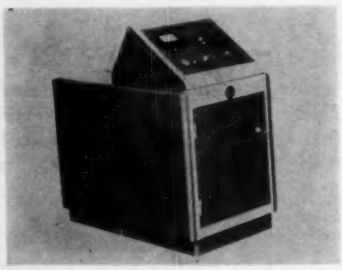
Multi-Amp Model 1002/3PHM central station has a rating of .2 kva, with an input of 115 volts, 60 cycles. A 220 volt variable autotransformer is used on 115 volt input for minimum distortion. "High" and "low" ranges are provided. Phase angle meter is Westinghouse Type K124 with 4½" face, accurate to ± 1 per cent, reading 0-360 electrical degrees. Voltmeter, Rectifier Type RC 37, accurate to ± 2 per cent, with the following voltage ranges: O-1.5/15/150. This meter may be also used independently of the unit.

The instrument is thoroughly portable, weighing less than 25 pounds. Multi-Amp Model 1002/3PH central station is also available. This has connections for phase angle meter and voltmeter as well as phase shifter, but does not include them. Weight 15 pounds.

For additional data, ask for item U-205, using the coupon on page 99.

High voltage a-c breakdown testers

A NEW SERIES of high voltage a-c breakdown testers covering ranges from 50,000 VAC to 100,000 VAC at capacities of 2 and 5 kva is announced by Associated Research, Inc.,



3777 West Belmont Ave., Chicago 18, Ill., manufacturer of a-c and d-c Hypot high voltage breakdown testing instruments.

These Hypots are designed for testing motors, generators, line materials, cables, liquids and insulating materials in accordance with ASTM and Federal specifications.

Continuously variable output voltage control from zero to maximum voltage as well as accurate measurement of applied test voltage with the kilovoltmeter connected directly across the actual output circuit are important features of the series.

Safety to test personnel is assured through zero return interlock on the voltage control, external safety interlock for remote "second man" output control and nonlocking push button switch.

Mobile caster mounted cases incorporate simplified controls and sleek, modernistic lines. Materials testing chambers and automatic rate of rise controls for test voltage are also available.

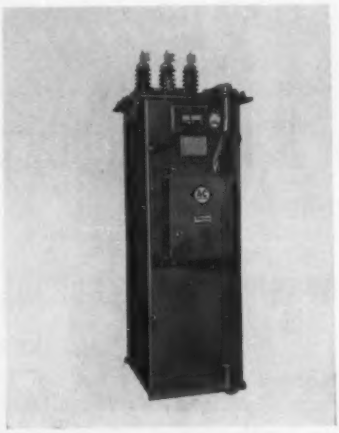
For additional data, ask for item U-206, using the coupon on page 99.

Single-phase power regulators redesigned

COMPLETE REDESIGN of its single-phase power regulators has been announced by Allis-Chalmers Manufacturing Co., 938 South 70th St., Milwaukee 1, Wis.

Again featuring unit-type construction, both the transformer and tap-changing mechanism of the redesigned unit are suspended from the cover to permit continuous leads to pass directly from the transformer coils to the double-bolt terminals on the dial switch.

This construction requires fewer bolted connections and makes it possible to remove or place the



mechanism and transformers in the tank as a unit without disconnecting leads or removing terminals.

A new feature is a hinged cover on the side of the unit making inspection of the tap-changing mechanism easy. To expose the mechanism, it is only necessary to lower the oil level, remove the bolts around the cover, and loosen the locknuts holding the upper end of the control conduit.

The redesigned power regulator's "Quick - Break" tap - changing mechanism, along the lines of the large distribution regulator mechanism, affords longer contact life and reduces maintenance. All parts of the mechanism are assembled on a common shaft and are self-aligning so no mechanical adjustments are needed.

The control equipment is mounted in a single chassis, enclosed in a weather-tight cabinet on the front of the regulator featuring plasticized corners for cushioning the paint against chipping.

The regulator features a new horizontal position indicator including the "Vari-Amp" feature which permits 25 regulating combinations. By means of this device it is possible to increase current capacity by reducing the range of regulation and to utilize unequal ranges to meet a system's exact needs.

The redesigned single-phase power regulator is available in 2500, 5000 and 7620 volt ratings in all standard sizes to provide ± 10 per cent regulation.

For additional data, ask for item U-207, using the coupon on page 99.

Aluminum substation structure studied

A COMPREHENSIVE study of electrical substation structures constructed of aluminum has just been published in booklet form by the Industry Development Dept., Kaiser Aluminum & Chemical Sales, Inc., 919 North Michigan Ave., Chicago 11, Ill.

The 48-page brochure, "Aluminum Substation Structures," has been prepared as a basic guide for engineers, designers, fabricators and erectors of substations and tells where and why the application of aluminum results in greater savings, better performance and longer life.

Twenty-eight pages are devoted to design information, charts and diagrams, covering structural details, safety factors, fastener clearances, deflection, ice and wind loadings and line loads. An important part of the design section includes a complete reprint of The American Society of Civil Engineers' paper #970 titled "Specifications for Structures of Aluminum Alloy 6061-T6." The ASCE specifications include allowable stresses, design rules and fabricating procedures.

Approximately 20 per cent of all substation structures in the United States are installed in coastal or industrial areas where a corrosive atmosphere prevails. The cost analysis section of the brochure presents graphic illustrations of how aluminum's resistance to corrosion brings about substantial savings over a period of time, compared to galvanized steel, because maintenance painting is not required. One example shows how after 20 years the total cost of a small galvanized steel substation, including maintenance, is 30 per cent greater than the cost of the same structure in aluminum.

Initial material costs, it is pointed

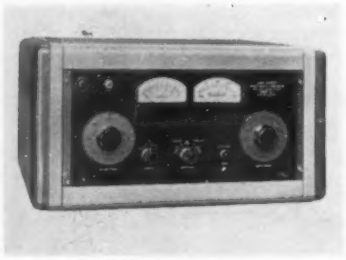
out, are higher for aluminum, but the costs of shipping and erecting structural members fabricated from the lighter metal are considerably lower. Cost figures in the Kaiser Aluminum booklet were developed over the past year in cooperation with fabricators and public utilities.

For additional data, ask for item U-208, Using the coupon on page 99.

Error measuring instrument for current transformers

FREEDOM from the effects of stray fields, harmonics, and heavy overload test currents is featured by the CTC current transformer Comparator available from Knopp, Inc., 1307—66th Street, Oakland 8, Calif.

With self-contained ammeter of 1, 10, and 20 ampere ranges the total burden imposed upon either the standard current transformer or the



transformer-under-test is less than 0.1 volt ampere. Included also is a detector for wrong polarity or other improper transformer connections.

Normal full scale error ranges are 0.64 per cent in ratio error with 0.01 per cent divisions and 35 minutes in phase error with one minute divisions. A range switch affords a multiplying factor of ten.

Overall accuracy is within one-half division for secondary currents from 0.5 to 20 amperes. Both ratio and phase errors are measured simultaneously and are direct reading. Full-scale ranges are 0.64 per cent and 6.4 per cent in ratio error and 35 minutes and 350 minutes in phase error. Except for the loading transformer and standard, no auxiliary equipment is needed.

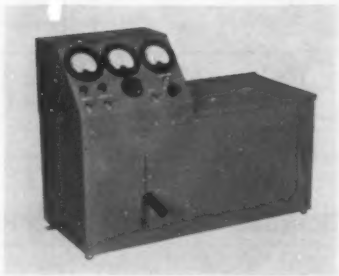
For additional data, ask for item U-209, using the coupon on page 99.

Two-minute calibration for street lighting controls

ACCURATE, two-minute calibration and circuit checking of any photoelectric street light control, regardless of type or manufacturer, is now possible with a new light control calibrator developed by Micro Balancing, Inc., Garden City Park, L. I., N. Y.

In use by some of the largest utilities, the instrument eliminates the need for returning the light control units for factory adjustment, thereby reducing down-time and delays.

Daylight at dawn or dusk is pre-



cisely simulated by a constant color temperature light, corrected with filters, and with a range of 0 to 5½ foot candles. The self-contained continuously indicating foot candle meter allows accurate readings of the proper light intensity, as determined by local conditions and requirements.

Any light control unit, whether actuated by phototube, cadmium sulfide cel, selenide, selenium cell, or other control device, can be accommodated. The instrument will handle all control units operating on 120 or 230 volts, 50 - 60 cycles.

For additional data, ask for item U-210, using the coupon on page 99.

Outdoor switchgear equipment eliminates rear access

A NEWLY designed, outdoor metal-clad switchgear equipment that provides control panels on the same side of the unit as the breakers has been announced by General Electric's Medium Voltage Switchgear Dept., Schenectady 5, N. Y.

Suitable to both utility and industrial application, the new equipment—rated 2.4 to 13.8 kv, 50 to 1000 mva—reduces foundation pad size and station space because access to rear of equipment is no longer necessary. New units are reduced in depth with no addition in width.

With breakers, relays and controls on one side, maintenance and testing is made easier and quicker. The control panel is mounted on an inside "dutch door" that swings out to provide easy access to bus connections. Breakers may be removed without disturbing the panel.

The new metal-clad design is also available with preassembled protected aisle as optional equipment.

For additional data, ask for item U-211, using the coupon on page 99.

Precoated connectors and tap clamps packaged individually

THE A. B. CHANCE CO., of Centralia, Missouri, is offering bolted connectors and tap clamps that have contact surfaces precoated with electrical contact aid. Each connector and clamp is individually packaged in a transparent plastic protective covering.

Precoated connectors and clamps speed installation, as they eliminate the time-taking chore of on-the-job application of contact aid to each connector or clamp. Precoated connectors and clamps help to insure good connections, since they are protected even if the lineman fails to use contact aid in making the connection.

The lineman does not have to remove his gloves to remove a connector or clamp from its protective covering. When the twisted end of the covering is snipped with side-cutters, the connector can be slipped free. Tapes on the covering remind the lineman to clean and apply contact aid to the conductors.

Chance z.l.n. 100 electrical contact aid is used on these precoated connectors and clamps. It guards against corrosion and improves conductivity. It is nontoxic, noninflammable, water-resistant, adhesive, and will not melt or become stiff through a temperature range of -25° to 340° F.

For additional data, ask for item U-212, using the coupon on page 99.

Microwave communications system slide rule

OF PARTICULAR INTEREST to communications engineers is a new slide rule designed by microwave engineers at Motorola Communications and Electronics, Inc., 1400 N. Cicero Ave., Chicago 51, Ill.

After countless calculations of path loss, antenna gain, fade margin, carrier-to-noise ratio and all the other mathematical manipulations that are required for planning a microwave communications system, the Motorola engineers developed the slide rule to simplify these calculations for microwave equipment users.

The slide rule itself contains 28 scales and is used on both sides. One side is used to rapidly calculate propagation characteristics over a broad range of microwave frequencies from 1,000 MC. to 30,000 MC. Included are Fresnel zone clearance, path loss, an-

tenna and reflector gain, beam width and other path perameter needed for system design. On the reverse side are scales for multiplex calculations including signal-to-noise ratio, carrier loading and all other related factors for both FM and single sideband multiplex system performance calculation.

For additional data, ask for item U-213, using the coupon on page 99.

New, revised estimating tables continued in this issue

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

CONDUIT STRAPS
WOOD MOUNTING
"ONE HOLE"

SIZE	HOURS EACH	LABOR COST EACH AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
1/2"	.05	.063	.075	.088	.10	.113	.125	.138	.15	.163	.175	.188
3/4"	.05	.063	.075	.088	.10	.113	.125	.138	.15	.163	.175	.188
1"	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30
1¼"	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30
1½"	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30
2"	.1	.125	.15	.175	.20	.225	.25	.275	.30	.325	.35	.375
2½"	.1	.125	.15	.175	.20	.225	.25	.275	.30	.325	.35	.375
3"	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45
3½"	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45
4"	.15	.188	.225	.263	.30	.338	.375	.413	.45	.488	.525	.563
5"	.2	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75
					"TWO HOLE"							
1/2"	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30
3/4"	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26	.28	.30
1"	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45
1¼"	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45
1½"	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39	.42	.45
2"	.15	.188	.225	.263	.30	.338	.375	.413	.45	.488	.525	.563
2½"	.15	.188	.225	.263	.30	.338	.375	.413	.45	.488	.525	.563
3"	.18	.225	.270	.315	.36	.405	.45	.495	.54	.585	.63	.675
3½"	.18	.225	.270	.315	.36	.405	.45	.495	.54	.585	.63	.675
4"	.2	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75
5"	.25	.313	.375	.438	.50	.563	.625	.688	.75	.813	.875	.938
6"	.3	.375	.45	.525	.60	.675	.75	.825	.90	.975	1.05	1.13

E-101-B

LABOR: INCLUDES SETTING SCREW AND INSTALLING STRAP.

2-58

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CONDUIT STRAPS
MASONRY MOUNTED
(DRILLING BY HAND)
"ONE HOLE"

SIZE	HOURS EA.	LABOR COST EACH AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
1/2"	.2	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75
3/4"	.2	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75
1"	.25	.31	.38	.44	.50	.56	.63	.69	.75	.81	.88	.94
1 1/4"	.3	.38	.45	.53	.60	.68	.75	.83	.90	.98	1.05	1.13
1 1/2"	.33	.41	.50	.58	.66	.74	.83	.91	.99	1.07	1.16	1.24
2"	.33	.41	.50	.58	.66	.74	.83	.91	.99	1.07	1.16	1.24
2 1/2"	.33	.41	.50	.58	.66	.74	.83	.91	.99	1.07	1.16	1.24
3"	.35	.44	.53	.61	.70	.79	.88	.96	1.05	1.14	1.23	1.31
3 1/2"	.4	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50
4"	.4	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50
5"	.5	.63	.75	.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88
		"TWO HOLE"										
1 1/2"	.4	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50
2"	.4	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50
2 1/2"	.45	.56	.68	.79	.90	1.01	1.13	1.24	1.35	1.46	1.58	1.69
3"	.45	.56	.68	.79	.90	1.01	1.13	1.24	1.35	1.46	1.58	1.69
3 1/2"	.45	.56	.68	.79	.90	1.01	1.13	1.24	1.35	1.46	1.58	1.69
4"	.5	.63	.75	.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88
5"	.5	.63	.75	.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88
6"	.6	.75	.90	1.05	1.20	1.35	1.50	1.65	1.80	1.95	2.10	2.25

E-102-B

LABOR: INCLUDES DRILLING ANCHOR AND SECURING STRAP.

2-58

CONDUIT STRAPS "ONE HOLE"
MASONRY MOUNTED
(DRILLING BY POWER)

SIZE	HOURS EACH	LABOR COST EACH AT FOLLOWING RATES										
		$1.25	$1.50	$1.75	$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75
1/2"	.15	.188	.225	.263	.30	.338	.375	.413	.45	.488	.525	.563
3/4"	.15	.188	.225	.263	.30	.338	.375	.413	.45	.488	.525	.563
1"	.2	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75
1 1/4"	.22	.275	.33	.385	.44	.495	.55	.605	.66	.715	.77	.825
1 1/2"	.25	.313	.375	.438	.50	.563	.625	.688	.75	.813	.875	.938
2"	.25	.313	.375	.438	.50	.563	.625	.688	.75	.813	.875	.938
2 1/2"	.25	.313	.375	.438	.50	.563	.625	.688	.75	.813	.875	.938
3"	.25	.313	.375	.438	.50	.563	.625	.688	.75	.813	.875	.938
3 1/2"	.3	.375	.45	.525	.60	.675	.75	.825	.90	.975	1.05	1.13
4"	.3	.375	.45	.525	.60	.675	.75	.825	.90	.975	1.05	1.13
5"	.35	.438	.525	.613	.70	.788	.875	.963	1.05	1.14	1.23	1.31
		"TWO HOLE"										
1 1/2"	.3	.375	.45	.525	.60	.675	.75	.825	.90	.975	1.05	1.13
2"	.3	.375	.45	.525	.60	.675	.75	.825	.90	.975	1.05	1.13
2 1/2"	.3	.375	.45	.525	.60	.675	.75	.825	.90	.975	1.05	1.13
3"	.35	.438	.525	.613	.70	.788	.875	.963	1.05	1.14	1.23	1.31
3 1/2"	.35	.438	.525	.613	.70	.788	.875	.963	1.05	1.14	1.23	1.31
4"	.4	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50
5"	.4	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50
6"	.45	.563	.675	.788	.90	1.01	1.13	1.24	1.35	1.46	1.58	1.69

E-102-B

LABOR: INCLUDES DRILLING ANCHOR AND SECURING STRAP.

2-58

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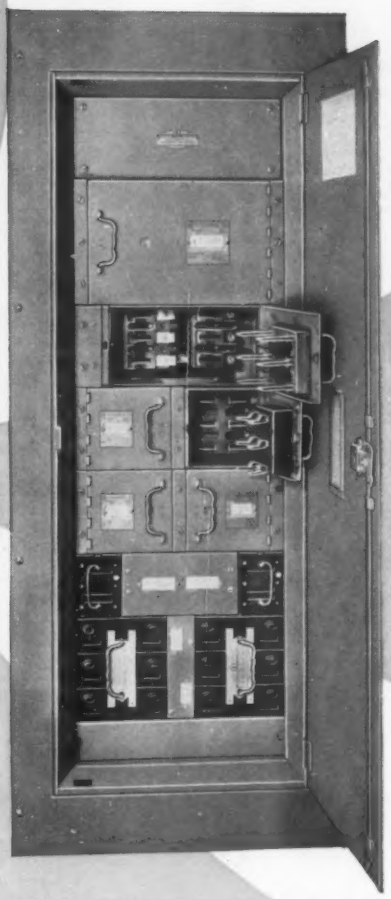
a quick solution to your feeder distribution problems

Frank Adam

panel base assembly type

feeder distribution panelboards



The next time you are confronted with a feeder distribution problem, install Frank Adam plug-in type Feeder Distribution panel boards.

You will be amazed to find how easy and quickly it is to install these new and better panelboards and how smoothly and efficiently they will solve your power distribution problem.

Frank Adam plug-in type panelboards are of the panel base assembly type which means that all components—mounting back with main bus bar and lugs, box and front and required switching units—are stocked on dealer's shelves for quick and easy installation on the job.

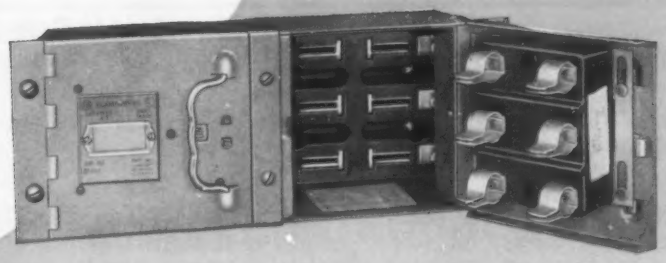
There's no installation delays, no interference with plant operations, no waiting for missing parts or factory assemblies. Just order from dealer's stock, install and go. It's as simple as that.

Two dependable Frank Adam switch units—the PFS (Pulfuzswitch) and the KSF (Klampswitchfuz)—make these panelboards the finest in safety and efficiency. Both switch units are of the operating type, horsepower-rated. Both combine switch and fuse into one unit so that the current is "off" when the fuse carriers are removed and the door opened.

Boxes too are standardized as to width, depth, and height to fit almost any electrical requirement and for easy stocking on dealer's shelves. Standard knockouts in ends are provided in the 19″ wide boxes and removable ends to permit drilling conduit openings on the job are provided in the 24″ boxes. Generous wiring space is another feature.

Like other Frank Adam products these panelboards are expandable. They not only provide the branch circuits needed for today, but they are so designed that future circuits and changes in capacities are a simple matter of plugging in new circuits.

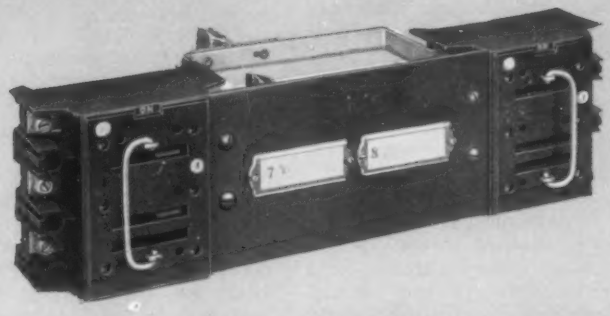
Specify these panelboards for all your future feeder distribution needs. You'll find that they are tops in performance, that they require less maintenance and that they will save you time, labor and money.



KLAMPSWITCHFUZ
hinged type

Combines both disconnect switch and fuse protection into one unit, assuring years of trouble-free service. Heavily electro-silver plated copper contacts clamp fuses under pressure for low resistance continuous duty.

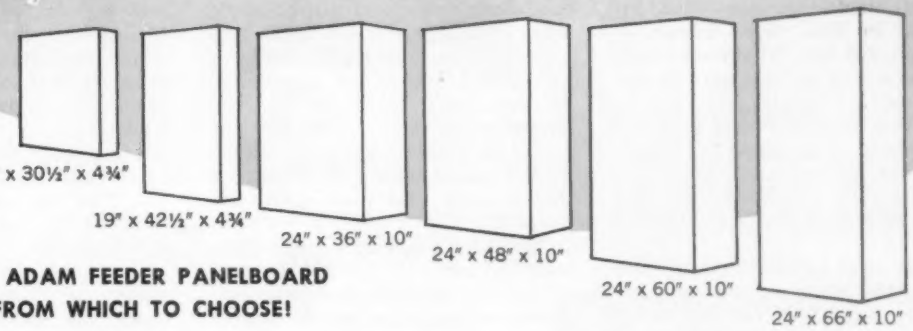
Access to fuses can be had only when door is opened. Doors can be closed in "on" or "off" position. Switch ratings are 30 to 600 amps., 240 volts AC, 250 volts DC, 2, 3 and 4 poles double or single throw.



PULFUZSWITCH
pull-out type

A safety type disconnect with pressure type fuseholders. To throw switch from "on" to "off" position, pull out fuse carrier—turn 180 degrees—and reinsert into base.

For maximum efficiency all current-carrying switch and fuse contacts are heavily electro-silver plated. Capacities are 30, 60 and 100 amp., 240 volts AC or 250 volts DC, 2 and 3 poles.



6 SIZES

OF FRANK ADAM FEEDER PANELBOARD CABINETS FROM WHICH TO CHOOSE!

Frank Adam Feeder Distribution panelboards in the panel base assembly type are available in six sizes ranging from 19 x 30 x 4¾ to 24 x 66 x 10, which means that there is a panelboard for virtually every need. Ask your nearest (FA) wholesaler or jobber about them.

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FRANK ADAM ELECTRIC COMPANY

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makers of

busduct • panelboards • switchboards • service equipment

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Know the law

by Arthur L. H. Street

Contractors cautioned in dealing with tenants

◆ IT IS A MISTAKE to suppose that an electrical dealer or contractor can improve leased premises under an arrangement with the tenant, and then necessarily enforce a mechanic's lien against the premises if the tenant does not pay.

That mistake was made in two recent cases—one decided by the Oklahoma Supreme Court, and one by the Colorado Supreme Court.

The Oklahoma case actually involved installation of plumbing; but, obviously, the decision would have been the same had installation of electric wiring been involved. In this case—Carter v. Simpson, 302 Pac. 2d 980—a building was leased for one year for use as a cafe. Possibly, the lessors knew that it would take painting and plumbing to adapt the building to the lessees' use. And, possibly, the rent was lower because the lessees were to stand the expense.

Under oral agreement with the lessees, the plumber was entitled to more than $400 for his work. But the tenants became bankrupt, and nothing could be collected from them. It was then, apparently, that the plumber, or his lawyer, conceived the idea that a lien could be enforced against the building, even though the lessors-owners had done or said nothing to indicate a willingness to pay, or guarantee payment of the bill.

Oklahoma statute

In Oklahoma there is a statute to the same effect as those in other states. It reads:

"Any person who shall, under oral or written contract with the owner of any tract or piece of land, perform labor, or furnish material for the erection, alteration or repair of any building, improvement or structure thereon or perform labor in putting up any fixtures, machinery in, or attachment to, any such building, structure or improvement; * * * shall have a lien upon the whole of said tract or piece of land, the buildings and appurtenances. If the title to the land is not in the person with whom such contract was made, the lien shall be allowed on the buildings and improvements on such land separately from the real estate."

The Supreme Court said:

"It will be observed that this statute provides for a lien where the contract is made with the owner; but if the land on which the material and labor is furnished is leased, and the title is not in the person contracting, the lien is on the improvements and leasehold estate, and not on the land; that is to say, the lien attaches only to the estate and interest owned by the person making the contract.

"The evidence in the instant case clearly discloses that plaintiff was contracting only with the lessees. Though he might not have had actual notice and knowledge of the lease under which the tenants were operating he was put on constructive notice and inquiry by the public records showing that the tenants did not own the property.

"Under the terms of the written lease no authority, either express or implied, was granted lessees to act for, or on behalf of, the owners of the property in contracting for any type of improvements on their building. To the contrary, the lease expressly provided that the lessors were to be held free of any costs incidental to the occupancy of the building. Thus, since no agency existed, we must conclude, under the statute above and the rules of this court that the lien, if any, could extend no further than the improvements, if any, constructed by plaintiff. This being true, the estate and interest owned by the defendants is not chargeable with the statutory lien for the labor and materials furnished."

Here the court seems to intimate that, so far as the plumbing was severable from the building without injury to the building, a lien might be enforced against the plumbing. But the writer does not understand that what the court said could justify allowing a lien against wiring or other electrical installation so installed that it could not be removed without injury to the structure.

Suit in Colorado

The Colorado case had to do with an electrical contractor's loss of a suit to enforce a lien for nearly $3,000 against a building unit that had been leased for five years. Under the lease, the tenants had the right to install such equipment as might be necessary to operate a commercial launderette. During the term of the lease the tenants, who were not parties to this suit, employed plaintiff to do electrical work required for the installation and operation of washing machines, dryers, flat work ironers, etc., upon the leased premises, in connection with their commercial operation. The tenants failed to pay for the work and materials furnished, and plaintiff filed a lien statement claiming a lien upon the property of defendants.

In ordering dismissal of the contractor's suit, the Colorado Supreme Court decided (Lierz v. Cook, 315 Pac. 2d 535):

1. The lien statement was not filed within the time required by Colorado law. "Whereas here, the work done by a lien claimant for a tenant is strictly on a cost-plus basis, the cessation of work for thirty days starts the statute running as to the period within which lien statements must be filed."

2. "Council contends that plaintiff has a valid lien because the defendants did not post a notice within five days after the work began on the premises leased to tenants to the effect that defendants' interests shall not be subject to any lien for the cost of any alteration or improvement of the premises. * * * Tenants were lessees in possession at the time they contracted with plaintiffs, **who knew that they were tenants.** The installations for which a lien is claimed were not for the primary benefit of the lessor, who did not agree directly or indirectly to reimburse lessees for the expense thereof. The alterations and installations were entirely optional with lessees for their sole use, benefit and convenience."

In Colorado, "where a lessee in possession is authorized by the

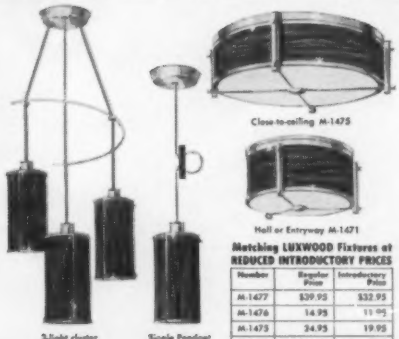
(Continued on page 98)

NOW! NEW! FABULOUS LUXWOOD® FIXTURES

Another MOE Light Promotional First that's new and powerful

FREE OFFER! INTRODUCTORY PRICES! FULL PROFITS!

FREE! This $12.95 ceiling track when you buy this beautiful pull-down fixture
MOVES ACROSS →
↓ PULLS DOWN
M-1479 reel pull-down . . . Smartly designed for today's living. Match or contrast your furniture with elegant real wood. Specially treated to accent the beautiful natural wood grain when fixture is lighted.
Special Introductory Offer complete with FREE 6-foot brass ceiling track . . . $49.95



Matching LUXWOOD Fixtures at REDUCED INTRODUCTORY PRICES

Number	Regular Price	Introductory Price
M-1477	$39.95	$32.95
M-1476	14.95	11.95
M-1475	24.95	19.95
M-1471	11.95	9.95

Introductory prices and special offer expire April 30, 1958

. . . to introduce stunning new

LUXWOOD®

by MOE Light

translucent fixtures of real wood

Here is LUXWOOD—most exciting lighting fixture idea years . . . real cabinet grain wood trimmed in gleaming brass . . actually translucent when lighted. Five matching fixtures to dramatize every room in your home.

To introduce LUXWOOD fixtures your dealer will give you a 6-foot brass ceiling track FREE (regular retail price $12.95) when you buy the M-1479 pull-down fixture shown above at the regular price of $49.95.

With the polished brass ceiling track and LUXWOOD pull-down fixture you can move the *light up or down and 6 feet in either direction.* Beautiful over dining tables, breakfast nooks or conversation furniture groupings . . . it's a conversation piece in itself.

Matching Luxwood fixtures by Moe Light are perfect for redecorating home, office or store. Get these matching fixtures at special low introductory prices.

Special prices and free offer expire April 30, 1958

1 REAL WOOD FIXTURES

Here's beautiful "Wood-n-Brass" LUXWOOD—real cabinet wood fixtures dressed in gleaming polished brass . . . matching any decor by day, translucent by night—a *home* decorator's dream of beauty come true.

2 FREE OFFER

To spearhead your promotion and bring in customers . . . and at NO COST TO YOU!

3 SPECIAL INTRODUCTORY PRICES

Reduced 30 day introductory prices to consumers . . . and you get your FULL PROFIT because you get special prices too!

4 POWERFUL PROMOTION

This full page—Full Color ad appears in April Better Homes & Gardens and House & Garden. A powerful push behind an exciting NEW line. Get in on this huge promotion TODAY.

This is Big! Let's go!

Special Prices and FREE offer expire April 30, 1958. Write, wire, phone your Distributor TODAY or send in coupon below.

THOMAS INDUSTRIES INC.
LIGHTING FIXTURE DIVISION
Executive Offices—410 S. Third St., Louisville 2, Ky.
Leaders in Creative Lighting

THOMAS INDUSTRIES INC. products: Moe Light and Star-Light lighting fixtures . . . Wright power saws . . . Radiant opal glass . . . Ideal bathroom cabinets . . . Electric Sprayit paint spraying equipment

THOMAS INDUSTRIES INC., Lighting Fixture Division, Dept. BH-4
410 S. Third St., Louisville 2, Ky.
Enclosed 25¢ in coin. Send 56 page full-color Moe Light Inspiration-Lighting decorator guide and catalog.

Name _____

Address _____

City _____ Zone ____ State _____

©1958 THOMAS INDUSTRIES INC

Builders, Electrical Contractors attach this coupon to your letterhead for copy of Moe Light catalog.

THOMAS INDUSTRIES INC.
LIGHTING FIXTURE DIVISION
Executive Offices: 410 S. Third St., Louisville 2, Ky.
Leaders in Creative Lighting

Thomas Industries Inc., MOE LIGHT Div., Dept. ES-2
410 S. Third St., Louisville 2, Ky.

The MOE LIGHT Promotion looks good to me. Send me details.

Name _____

Store Name _____

Address _____

City _____ Zone ____ State _____

My Distributor is: _____

_____

See how they work that

At this giant strip mine, the Tiger Brand Amerclad (shown in foreground below) is tortured by being dragged over razor-sharp rock and constantly pelted by flying fragments that are being blasted. It lies in the sun, rain and snow during the 24-hour workday.

Tiger Brand Amerclad

In wet or dry locations!

VERY FRANKLY, we do not make a range of Tiger Brand Amerclad qualities. When you see the Tiger Brand Amerclad mold identification on a length of portable cord or cable, you can be quite sure that nothing better can be purchased, no matter how much you want to spend for it.

The reason is that American Steel & Wire has catered strictly to the *heavy-duty* market where portable cord or cable is concerned. We're well aware that cable failure can be one of the most exasperating production difficulties that you can encounter. Expensive too, because nothing operates without power.

So the greatest care is lavished on Amerclad. Every inch of cable is vulcanized in a freshly cast lead sheath to insure a dense, tough, homogeneous sheath. Mechanical skimmers remove dross from the lead-melting pots, and the pots themselves are kept in an inert gas atmosphere to prevent formation of impurities.

The result is an amazingly tough and durable cable with precisely centered conductors that withstands mechanical abuse, water, oil, grease, gasoline, ozone, heat and cold. Ask your AS&W salesman for the story . . . and a catalog.

AMERICAN STEEL & WIRE DIVISION
United States Steel, General Offices: Cleveland, O.
Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, New York

The workman is holding an electric concrete tamper that knocks the entrapped air out of the mix before it sets—giving a denser, stronger concrete. The tamper is equipped with Tiger Brand Amerclad. It's dragged through wet concrete, over piling and beams, run over by trucks. Yet the manufacturer says he has never had a complaint about the cable.

Watch the **United States Steel Hour** on TV every other Wednesday (10 p.m. Eastern time).

USS TIGER BRAND ELECTRICAL WIRE & CABLE

a standard Tiger Brand cable for every special job

- Asbestos Wire and Cable
- Mold Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

UNITED STATES STEEL

USS TRADEMARK

News of the industry

edited for Southern readers

Atlantan elected IAEI president

DEWEY JOHNSON, superintendent of electrical affairs for the city of Atlanta, has been elected international president of the International Association of Electrical Inspectors. He is a past president of the Southern Section, IAEI, and has served the IAEI in many other capacities.

Mr. Johnson became an inspector for the City of Atlanta in 1929 and has held the position of Superintendent of Electrical Affairs since 1932. He began service on the Electrical Committee of NFPA in 1939 as a representative of the United States Conference of Mayors and has served continually since that time. He has been a member of various Code Making Panels, including numbers 1 and 3.

Dewey Johnson

Mr. Johnson is a native of Georgia, born near Bainbridge, and spent his early years on the farm. His first employment was with the Atlantic Coast Line Shops in Jacksonville, Fla. In 1917, he enlisted for military service in World War I and served until an injury brought about his discharge from the service. Entitled to vocational rehabilitation, he chose the electrical industry and worked for various electrical contractors on construction projects, while attending night school to obtain technical training.

Heating Fair promoted by Mississippi utility

MISSISSIPPI'S electrical industry supported National Electric Week with an Electrical Heating Fair and numerous talks on the industry by representatives before civic clubs.

B. M. Davis of Mississippi Power & Light Co., who led the state committee on NEW, said that nine heat pump and fourteen resistance heating equipment manufacturers were represented at the Heating Fair with exhibits of their equipment, and each firm provided an attendance prize.

Mississippi Power & Light Company sponsored the Fair in Jackson and gave widespread publicity to the event, held February 13-15.

"On February 11 and 12 special groups associated with the electrical industry were invited in advance to view equipment and discuss it with manufacturers," Davis said. The event was open to the public the remaining three days.

Companies represented with heat pumps included: Carrier, Chrysler, Fedders, General Electric, Gibson, Laurel Products, Mathes and Westinghouse.

Resistance heating equipment on display included Cavalier, Ceilheat, Chromalox, Dixie Raydiant Glass, Electrend, Electromode, Everwarm, General Electric, Indeeco, Markel, Meier, Thermador, Wesix, and Westinghouse.

The Heating Fair was part of MP&L's current campaign promoting electric heating. The company announced an all-electric rate last September and is promoting electricity for heating throughout Western Mississippi, its service area.

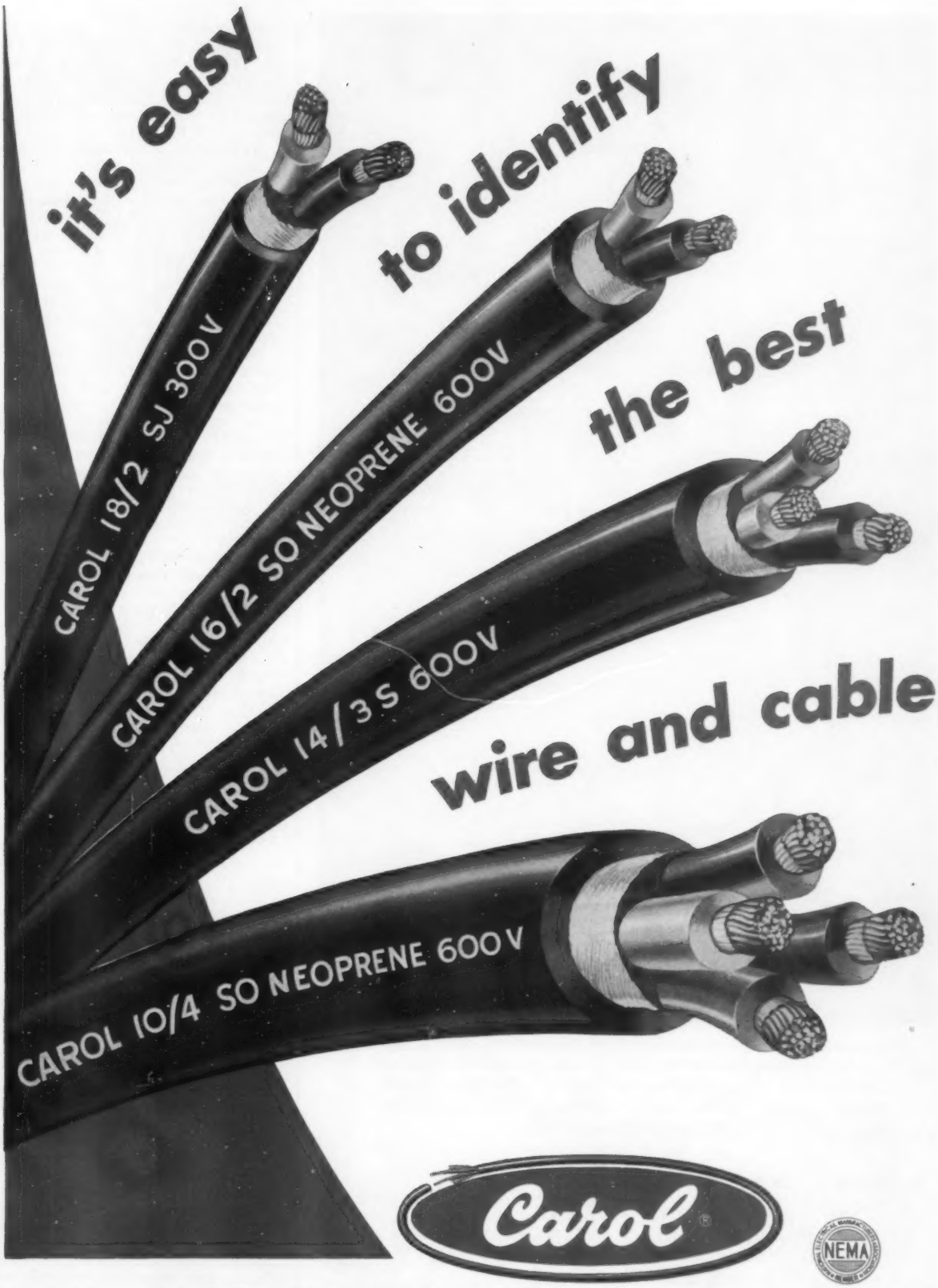
Southern industry expansion cited

INDUSTRIAL expansion plans during the next decade must and will give prime consideration to southern states, according to William W. Wright, budget director of the Johns-Manville Corporation.

In an address before the National Society for Business Budgeting on the Planning and Control of Industrial Operations, he pointed out that in line with this forecast Johns-Manville has built new plants in the Southern States of Virginia, Georgia, Mississippi, Louisiana and Texas since the depression, has established no new plant locations in Middle Atlantic or Middle Western states, and built only one new plant in the Northeast.

This trend towards giving spe-

Planning for National Electric Week began in Mississippi with the meeting of this group in Jackson. Left to right, sponsor representatives are: L. O. Bradshaw, Mississippi Power & Light Co.; Stuart C. Irby, Sr., and Joe Williams, NAED; B. M. Davis, MP&L, who heads the state NEW committee; C. B. Grauer, IAEI; Norvell Ogden, member of national committee sponsoring NEW; and John Sullivan and Chris P. Haynes, Mississippi Chapter, NECA. Committee members not shown are V. J. Daniel, Jr., Mississippi Power Co.; N. D. Woodward and C. E. Shaffer, IBEW.



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have your

Westinghouse representative

tell you how you can

STOP
LINE OUTAGES
CAUSED BY BIRDS
AND SQUIRRELS

Now—an all-new plastic-coated cover for distribution transformers above 5 kv offers new protection against line lockout . . . Another answer to changing needs, made possible by Plowback of earnings into distribution transformer research and development.

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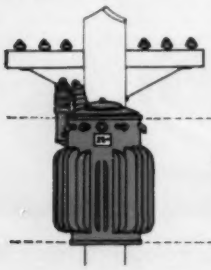


YOU CAN BE SURE... IF IT'S

Westinghouse

cial consideration to the growth areas such as the South and West prevails throughout industry, and is based on economic progress in the South and West, as well as the development of new and improved sources of industrial power.

Population projections also play a part, and these indicate that in another twelve years half the population of the United States will be in these areas. Indicative of the speed of this trend is the fact that in the South Atlantic area alone government figures show that industrial jobs increased almost 50 per cent above the national average during the fifteen years preceding 1954.

Mr. Wright predicted "continued advancement of the South in gaining new industry and providing ever-increasing markets for its own and other areas' products. Southern business and political leaders are taking effective steps towards fostering not just industrialization per se, but the kind of industrial expansion in which communities may be justly proud," he said.

"The South has a great deal to offer, in addition to definite financial inducements and friendliness. It has raw materials, markets, transportation, and a labor supply ample in quality and quantity."

"Many businesses," he said, "will find it desirable to put a left turn on Horace Greeley's map so that his advice will be changed to 'Go South.' "

Tulsa to be host to Southwest AIEE

TULSA will be host to the Southwest District Meeting of the American Institute of Electrical Engineers, March 31-April 2, R. K. Lane, general chairman, has announced. The meeting, which will be held in the Mayo Hotel, is expected to be attended by electrical engineers, industrialists, scientists and engineering educators from the District's seven-state area, including Kansas, Missouri, Arkansas, Oklahoma, New Mexico, Texas and the northern part of Louisiana.

The keynote address at the opening session will be given by Mr. Lane, who is chairman of the board of the Public Service Company of Oklahoma. Prof. Norman F. Rhode, Texas A. & M. College, and vice-president of the Southwest District of AIEE, will preside.

At the Monday luncheon, held jointly with the Engineer's Club of Tulsa, the principal speaker will be H. M. Milton, assistant secretary of the Army.

Fourteen technical sessions are scheduled for the three-day con-

clave. These will include reports of latest advancements in the fields of industry, system engineering, engineering education, petroleum production, aircraft, power distribution, and transmission and communications. Inspection trips will include the expanded Tulsa power plant of the Public Service Company of Oklahoma.

Chairmen assisting Mr. Lane are: Dwight Allison, vice-chairman; F. N. Wightman and G. R. VanBurkleo, program and meeting papers; J. L. Hixon, finance and budget; R. D. Bennett, hotel arrangements; H. A. Norberg, inspection trips; H. M. Furtney, registration; R. I. Moore, publicity; and Jack C. Wells, entertainment.

Housepower announces Spring contest plans

THE 1958 SPRING Housepower Contest, to run from February through April, has been launched with a forceful national advertising campaign to back up unlimited opportunities for local tie-in promotion.

Edison Electric Institute members participating in the 1958 Housepower Fund will provide $10,000 in cash prizes and funds for contest administration. Thirty manufacturers will provide electrical appliance prizes worth $90,000.

Richard Manville Research, Inc., will judge entries, validate winners, and simultaneously notify winner, prize donor and interested EEI member. Contestants must write a caption for a low Housepower cartoon.

EEI members underwriting the cost of administering the contest will receive the return portion of the entry coupon for use as wiring modernization leads.

Local promotion ideas include complete TV and radio programs, display kits, direct mail and newspaper campaigns. House organ articles, newsletters, bulletin board notices, wiring sales contests and varied consumer contests are also available.

Missouri power rates reduced

ALL POWER RATES of the Coast Electric Power Association, of Bay St. Louis, Mo., have been reduced —including as much as a twelve per cent decrease in residential rates and fifteen per cent in commercial rates.

The new rates will mean savings of over $50,000 annually to the more than 7,000 members throughout the company's rural areas of Hancock, Harrison and Pearl River counties, according to H. H. Shattuck, manager.

Oklahoma association names 1958 officers

OFFICERS FOR the coming year were recently announced by the Oklahoma Utilities Association. Dale E. Frieden, Zenith Gas System, Inc., of Alva, was elected president.

Wright Canfield, vice-president, Public Service Company of Oklahoma, Tulsa, will serve as first vice-president and George F. Peck, Jr., regional manager for the Lone Star Gas Co., Pauls Valley, becomes second vice-president.

H. H. Ferrin, vice-president and treasurer, of the Oklahoma Gas and Electric Co., at Oklahoma City, was elected treasurer. Miss Thelma T. Jones will serve as secretary, address: Suite 2415, Oklahoma Biltmore Hotel, Oklahoma City.

The association will hold its annual convention March 27-28, at the Oklahoma Biltmore Hotel in Oklahoma City. Wright Canfield is convention chairman.

Kansas association elects officers

G. E. MESSER, General Electric Co., was elected president of the Electric Association of Kansas City at that organization's 46th Annual Meeting.

Mr. Messer succeeds William Carter, district manager of Anaconda Wire and Cable Co.

In 1926, shortly after graduation from the University of Colorado with a B.S. degree in Electrical Engineering, Messer joined General Electric, and has been with the company ever since, with time out for service as a Naval Officer in World War II. Before coming to Kansas City in 1952, Messer served the Company in Chicago, Detroit and St. Louis.

Division vice-presidents elected include: utilities, Robert K. Zimmerman, Kansas City Power & Light Co.; manufacturers, Marshall Bliss, Westinghouse Electric Corp.; supply wholesalers, W. B. Whaley, Graybar Electric Co.; appliance wholesalers, E. D. Shiffler, General Electric Supply Co.; appliance dealers, Axel Nelson, Jenkins Music Company; maintenance repair and service, John E. Launder, Independent Elec. Machinery Co.; manufacturers agents and representatives, Charles L. Arehart, C. L. Arehard Co.; electrical contractors, George E. Trinastich,

Now . . .
serve bulk loads
from the
pole top

WITH
250-KVA
DISTRIBUTION
TRANSFORMERS

Have your Westinghouse representative give you the full story about . . . a better answer to a changing need.

J-70838

YOU CAN BE SURE...IF IT'S

Westinghouse

Squire Electric Co.; television service dealers, James N. Blair, Blair Radio and TV; radio and TV broadcasters, E. K. Hartenbower, KCMO Broadcasting Co.

C. M. Anderson, of General Electric Co., was reelected secretary-treasurer. John S. McDermott is executive manager of the association.

Gulf Coast NECA names new officers

AT A RECENT meeting in Mobile, Ala., of the Gulf Coast Chapter of the National Electrical Contractors Association officers were elected for the coming year.

Succeeding W. S. Barrow as president will be H. R. Bryars, owner of a Mobile electric construction company. C. E. Toliver was elected vice-president and G. R. Woods, treasurer.

New electric league elects officers

THE BUNCOMBE County Electric League has been organized in Asheville, N. C., to promote unity among members and foster better electric service.

Officers are R. W. Cook, Cook Electric Co., president; J. E. Keenan, United Electric Co., vice-president; Abe Anders, Allied Electric Co., treasurer; and Jennings Featherstone, Carolina Power and Light Co., secretary.

A ten-acre tract leaves ample room for expansion at Federal Pacific's new Atlanta plant shown in the architect's sketch above. Production facilities, warehouse, and Southeastern regional sales offices will be housed in the 45,000 sq. ft. area. Operations will begin in April.

Federal Pacific expands in South

FEDERAL PACIFIC Electric Company's new regional manufacturing plant in Atlanta, Ga., is scheduled to begin operations in April, according to an announcement by T. M. Cole, executive vice-president.

"We see the new installation as providing better service for the area and helping it to meet its rapidly increasing electrical requirements," Mr. Cole explained. He pointed out that the industrial expansion predicted for the Southeast in the next ten years called for an 84 per cent planned increase of electrical generating capacity.

The new plant covers 45,000 square feet, with room to expand over the remainder of a 10-acre tract. Containing 30,000 square feet of production space, it includes a modern warehouse and offices for the company's Southeastern sales region.

The manufacturing unit will be devoted to the fabrication and assembly of panelboards, switchboards, motor control centers, and special enclosures. It will service industrial, commercial and electric utility customers in the states of North and South Carolina, Georgia, Florida, Tennessee, Virginia, Mississippi, Louisiana and Alabama.

Manager of the new facility, in charge of all plant operations, will be S. T. Stendera, a native of Atlanta. A graduate of Georgia Tech, Mr. Stendera has twenty years experience in the electrical field. W. L. Sullivan will be regional sales manager, and D. P.

FLYING REPRESENTATIVE—R. G. "Bam" Price, Jr., southeastern district sales manager for Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y., and Newark, Cal., manufacturer of non-metallic pipe, prepares to take off across his 1400-mile territory. Mr. Price, with regional headquarters in Atlanta, Ga., relies on his CESSNA 172 to better service Orangeburg's markets in the southeast, expanding as a result of the company's entry into the plastic pipe field.

Lacock will manage apparatus sales to utilities.

The new installation located at 5745 Peachtree Industrial Boulevard will greatly extend the scope of company activities currently conducted from facilities at 1261 Chattahoochee Avenue, N.W., in Atlanta.

New Orleans elects association officers

FRANK PRATTINI was chosen to lead the activities of the Electrical Association of New Orleans at a recent meeting for the election of officers for the coming year.

In addition to Prattini the following were elected: W. H. Bramblett, executive vice-president; John C. Marden, vice-president, wholesalers, utilities, and mfgrs.; George E. Marcuse, vice-president, appliance; W. H. Mentrup, vice-president, electrical contractors; Ned A. Breitenmoser, vice-president, air conditioning and ventilation; Ray L. Conner, vice-president, radio and television; W. E. Clement, director of publicity; S. A. Cuyler, secretary; A. M. Brewer, treasurer.

The executive committee elected for 1958 is composed of: Wes P. Massey, Wayne D. Baker, C. G. Glueck, Allen W. Betz, Emile B. Barris, E. A. Rodrigue, E. N. Avegno, J. B. Habans, C. K. Naumann, A. B. Paterson, ex-officio.

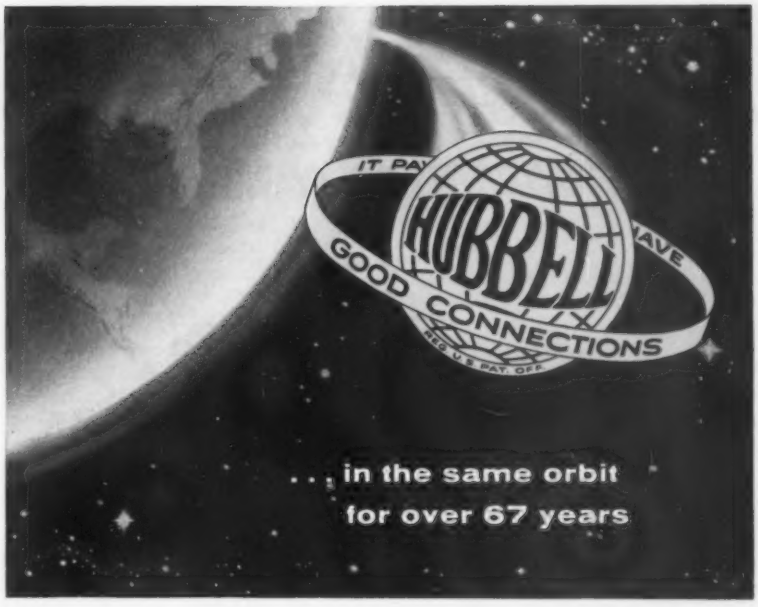
In accepting the gavel the new president paid tribute to the fine work of the outgoing officers. He pledged himself to forward the objectives of the association, and stated that plans are already under consideration which will make 1958 another successful year in the history of the electrical industry in New Orleans.

Retiring President A. B. Paterson made a most interesting and informative report which covered the activities of the association during his term of office. This report gave evidence that 1957 was a successful year in many ways.

Messick addresses Kansas association

Members and guests of the Electric Association of Kansas City at a recent meeting heard Laurance C. Messick, managing director of the National Lighting Bureau, New York City, speak on "Certified Lighting."

Mr. Messick's interesting talk pointed out the background, development, as well as the sponsoring bodies of the National Light-



It has been Hubbell's policy for more than 67 years—to distribute its products exclusively through the electrical distributor and cooperate in every possible way—to assist him in conducting his business profitably, efficiently, and in accordance with good business practice.

This non-competitive policy of cooperation, established and maintained since 1888, is the foundation of Hubbell's continued association and relationship with the leading electrical distributors throughout the United States.

Hubbell's policy . . .

"COOPERATION, NOT COMPETITION"

HARVEY HUBBELL, INC.

QUALITY WIRING DEVICES

Dept. R-2 BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE OFFICE AND WAREHOUSE LOCATIONS

Bridgeport 2, Connecticut
State and Bostwick Streets

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37 South Sangamon Street

Los Angeles 12, California
103 North Santa Fe Avenue

San Francisco, California
1675 Hudson Avenue

Dallas 7, Texas
1111 Dragon Street

IN CANADA:
Scarborough, Ontario
1160 Birchmount Road

PUT 'EM DOWN BY MACHINE to cut anchoring costs!

Many utilities have found that anchor installation time and costs can be cut to the minimum by installing Chance Screw Anchors with their hole boring machines. They use the Chance "Blackfoot" because its special features—correct blade pitch, small hub, large thimbleye—were designed for use with boring machines. These features also mean greater holding power and easier installation of these anchors when they are screwed down by hand.

the CHANCE "BLACKFOOT"*

***the line crew's name for the line crew's choice.**

–King-size thimbleye accommodates big turning bar or boring machine adaptor.

–Smaller hub means less earth disturbed during installation. Adds to holding power.

–Blades are accurately "pitch-controlled" for fast-cutting, speedy installation.

Chance Screw Anchors are available in sizes from 4" to 15" in diameter. You can get them from stock from your anchor distributor.

. . . and there are CHANCE ANCHORS for all other soil and guying conditions . . .

CA58-5

A·B·CHANCE CO· CENTRALIA MISSOURI

(A·B·CHANCE CO. of Canada, Ltd., Toronto)

ing Bureau and more specifically the reasons for and the details of a Certified Lighting Program.

With the use of color slides and narrative he illustrated to the group how the Certified Lighting Program can be utilized in the local metropolitan area to further expand the volume of business in the relighting market for the contractor, the manufacturer and jobber, and the utility.

Mr. Messick's presentation highlighted the basic parts of the Certified Lighting program which consist of four important activities: (1) Technical training in lighting layout, (2) Training in creative selling of lighting installations, (3) Certification of lighting installation plans, and (4) Promotion of Certified Lighting.

He pointed out that a creative sales training program tailored for electrical contractors which illustrates how each can utilize existing manpower for greater profit in the relighting market is available through the National Bureau. There are now eighteen active local bureaus throughout the country, utilizing the national program with considerable success.

In addition to being guest speaker at the luncheon meeting, the Kansas association arranged for three other special meetings with segments of the industry. A breakfast meeting for contractors was held at the President Hotel. In mid-morning a special meeting of manufacturers and jobbers was held in the Electric Association office. In mid-afternoon a meeting was held with utility representatives.

As a result of these meetings, which outlined in detail the specific responsibilities and benefits for each particular segment of the industry in a local Certified Lighting Program, serious consideration is now being given to the possibility of setting up a local Certified Lighting Bureau to serve the metropolitan Kansas City area. Additional local meetings will be held to determine the feasibility of such a program.

IAEI recommendations on circuit breakers

WHEN the various geographical divisions of the IAEI held their annual meetings in 1957, each section came up with a different set of recommendations as to proposed changes relating to circuit breakers, National Electrical Code sections 2481. To simplify this situation, an IAEI committee was appointed to draft a single set of recommendations which would then become the IAEI recommendations when the Electrical Com-

(Continued on page 82)

Dates Ahead

Edison Electric Institute, Meter and Service Committee, Sheraton Hotel, Philadelphia, Pa., Feb. 17-19, 1958.

National Adequate Wiring Conference, Detroit, Mich., Feb. 20-21, 1958.

Southern Safety Conference and Exposition, Peabody Hotel, Memphis, Tenn., March 2-4, 1958.

International Association of Electrical Inspectors, Mississippi Chapter Meeting, Heidelberg Hotel, Jackson, Miss., March 2-4, 1958.

Electrical Equipment Representatives Association. Annual Meeting, St. Charles Hotel, New Orleans, La., March 5-8, 1958.

American Institute of Electrical Engineers, Textile Conference, Georgia Institute of Technology, Atlanta, Ga., March 13-14, 1958.

International Association of Electrical Inspectors, Georgia Chapter Meeting, Daniel Ashley Hotel, Valdosta, Ga., March 24-25, 1958.

Edison Electric Institute, 24th Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 24-27, 1958.

Oklahoma Utilities Association, Annual Convention, Biltmore Hotel, Oklahoma City, March 27-28, 1958.

American Institute of Electrical Engineers, Pulp and Paper Conference, North Carolina State College, Raleigh, N. C. March 27-29, 1958.

Southeastern Electric Exchange, Annual Conference, Boca Raton Hotel and Club, Boca Raton, Fla., March 31-April 2, 1958.

American Institute of Electrical Engineers, Southwest District Meeting, Mayo Hotel, Tulsa, Okla., March 31 - April 2, 1958.

International Association of Electrical Inspectors, South Carolina Chapter Meeting, Columbia Hotel, Columbia, S. C., April 3-4, 1958.

International Association of Electrical Inspectors, Ellis Cannady Chapter, Carolina Hotel, Raleigh, N. C., April 8-9, 1958.

Illuminating Engineering Society, East Central Regional Conference, Richmond, Va., April 14-15, 1958.

Protective Relay Conference, Eleventh Annual Conference, Texas A&M College, College Station, Tex., April 14-16, 1958. Write L. M. Haupt, Conference Chairman.

Southeastern Electric Exchange, Heat Pump Steering Committee, Leisure House, Tampa Electric Co., Tampa, Fla., April 16-18, 1958.

International Association of Electrical Inspectors, Alabama Chapter Meeting, Hotel Stafford, Tuscaloosa, Ala., April 17-18, 1958.

Southeastern Electric Exchange, Engineering and Operation Section, Buena Vista Hotel, Biloxi, Miss., April 21-22, 1958.

Illuminating Engineering Society, South Central and Southeastern Joint Regional Conference, Hotel Lafayette, Little Rock, Ark., April 24-25, 1958.

International Association of Electrical Inspectors, Baton Rouge Chapter, Baton Rouge, La., April 28, 1958.

American Institute of Electrical Engineers, Middle Eastern District Meeting, Washington, D. C., April 28-30, 1958.

Illuminating Engineering Society, Southwestern Regional Conference, Shreveport, La., April 28-29, 1958.

American Institute of Electrical Engineers, Middle Eastern District Meeting, Washington, D. C., April 28-30, 1958.

Illuminating Engineering Society, Midwestern Regional Conference, Kansas City, Mo., May 1-2, 1958.

International Association of Electrical Inspectors, George Welman Chapter, New Orleans, La., April 29, 1958.

International Association of Electrical Inspectors, Joint Meeting (Baton Rouge, George Welman, North Louisiana—East Texas, Texas Gulf Coast, and North Central Division Texas Chapters, Angelina Hotel, Lufkin, Texas, May 2-3, 1958.

International Association of Electrical Inspectors, Florida Chapter Meeting, Cherry Plaza Hotel, Orlando, Fla., May 8-10, 1958.

International Association of Electrical Inspectors, Virginia Chapter Meeting, Ingleside Inn, Staunton, Va., May 12-13, 1958.

Edison Electric Institute, Electrical Equipment Committee, Radisson Hotel, Minneapolis, Minn., May 12-13, 1958.

American Institute of Electrical Engineers, East Central District Meeting, Huntington, W. Va., May 13-15, 1958.

Southeastern Electric Exchange, Industrial Power Sales Conference, Edgewater Gulf Hotel, Gulfport, Miss., May 29-30, 1958.

National Telemetering Conference, (AIEE-ISA-IAS), Lord Baltimore Hotel, Baltimore, Md., June 2-4, 1958.

National Association of Electrical Distributors, 50th Annual Convention, Civic Auditorium, San Francisco, June 9-13, 1958.

American Institute of Electrical Engineers, Summer General Meeting, Buffalo, N. Y., June 22-27, 1958.

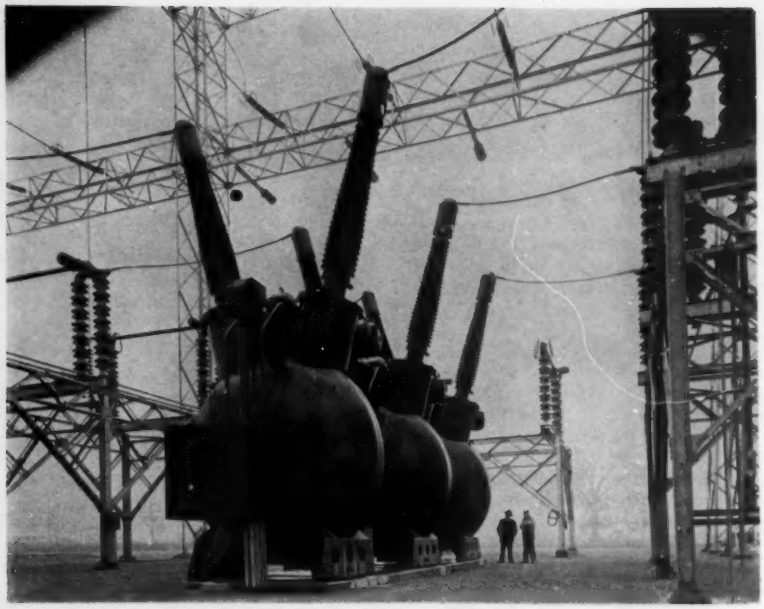
American Institute of Electrical Engineers, Petroleum Industry Conference, Baker Hotel, Dallas, Sept. 15-17, 1958.

Edison Electric Institute, Meter and Service Committee, Plaza and Driscoll Hotels, Corpus Christi, Texas, Sept. 22-24, 1958.

Southeastern Electric Exchange, Engineering and Operation Section, Hotel Roanoke, Roanoke, Va., Oct. 20-21, 1958.

International Association of Electrical Inspectors, Southern Section Thirtieth Annual Meeting, McAllister Hotel, Miami, Fla., Oct. 20-22, 1958.

National Electrical Contractors Association, Annual Convention, Dallas, Texas, Nov. 19-22, 1958.



25,000,000 KVA INTERRUPTING CAPACITY—The above FGK power circuit breaker, manufactured by the General Electric Company, is rated for 345 kv service with maximum interrupting capacity of 25-million kva. Philip Sporn Station near New Haven, West Virginia is supplied with similar equipment.

mittee of NFPA considered this Code section for revision.

This IAEI committee, consisting of E. E. Carleton, William Hogan, Chris Klawa, Dewey Johnson, and Frank Stetka, met recently and accepted the following changes as the IAEI recommendations:

"2481 (d) Non-Tamperable. The construction of a trip unit shall be such that the normal rated load and overload calibration cannot be adjusted without breaking a seal or permanent fastening even when the unit is removed from the breaker.

"2481 (e) (Wording remains the same but change numbering to 2481 (g).

"2481 (e) Classification. Circuit breakers rated not more than 100 amperes shall conform to the following classifications:

"Not over 250 volts: amperes, 0-20, 21-30, 31-60, 61-100.

"Not over 600 volts: amperes, 0-20, 21-30, 31-60, 61-100.

"2481 (f) Non-Interchangeable. It shall be impossible to replace a circuit breaker of a given classification, as referred to in paragraph (e) of this section, once installed, with one of a higher classification except by a major alteration by approved means, of the circuit breaker and/or the circuit breaker receiving equipment. The design of circuit breakers shall be such that two or more circuit breakers cannot be installed in the space intended for a single circuit-breaker, unless approved for such use."

St. Petersburg branch opened by sales agency

A NEW BRANCH office of the electrical manufacturers representatives' firm, Belcher and Associates, Inc., has been established at St. Petersburg, Fla., at 710 Central Avenue. This sales organization, headed by H. Jack Belcher, has recently moved its headquarters offices into its own building and warehouse at 8751 Atlantic Boulevard, Jacksonville.

Representing a number of electrical equipment manufacturers in the states of Alabama, Florida and Georgia, the Belcher organization also operates branch offices in Atlanta, Birmingham, and Miami.

Brief news notes of manufacturers

WAREHOUSE stocks are now being maintained for the immediate delivery of Star-A Electric Mfg. Company's line of wiring devices by Jules J. Dreyfuss' Sons in Atlanta, Miami and New Orleans. The Dreyfuss concern has represented Star-A in the southeastern states for the past fifteen years.

* * *

ADMINISTRATIVE headquarters for the ten-state southern sales area of Motorola Communications and Electronics, Inc., is now being completed in Dallas, Texas. The 12,000 square foot building will house a two-way radio sales office, an expanded Motorola parts depot and a microwave and industrial control sales office as well as the administrative office of the Southern area.

* * *

TO MEET the increased demand for its electric space heating equipment, The Electromode Division of Commercial Controls Corp., has moved into a modernized plant at 570 Culver Rd., Rochester, N. Y. The Company has more than 80,000 sq. ft. of manufacturing space and storage facilities at their new address. The former plant on Crouch Street continues in operation for certain manufacturing processes.

* * *

PARANITE Wire and Cable Division of Essex Wire Corporation has broken ground for its new factory warehouse to be located adjacent to the Marion, Ind., manufacturing plant. As a part of the $1,000,000 Paranite expansion program, this new warehouse with over 100,000 sq. ft. of floor area, will provide facilities for the storage and immediate shipment of Paranite Wire and Cable products.

Clark organizes four new divisions

ESTABLISHEMENT of four new electric control product divisions and appointment of two general divisional managers has been announced by Clark Controller Co., of Cleveland. The new divisions are:

Automation Division, which will handle engineered control systems and standardized controls for applications requiring integrated control systems, such as mill drives, processing lines, conveyor systems, and machine tools.

Packaged Drive & Control Centers Division, which will handle standard, modified standard, and specially - engineered packaged speed control drives, and control centers.

Crane & Mill Accessory Controls Division, which will handle heavy-duty standard and modified standard control equipment for materials handling, mill auxiliaries, and accessory drives such as pumps, mixers, compressors, and welders.

Standard Products Division, which will handle standard and modified standard general-purpose starters, relays, limit switches, and similar equipment.

In addition, Clark has two previously-established product di-

Your Work Can Wait!

"By George, it's almost human, isn't it?"

"Along with my references, I brought samples of my filing"

"Simmons does his best work under pressure"

"What a dream I had last night! I met this beautiful blonde who invited me to her apartment... her brother turned out to be an engineer and came to work for us!"

visions: the Renewal Parts Division, and the American Electric Switch Division which handles residential and commercial building service entrance switches and related equipment.

R. L. Puette has been named general divisional manager for the heavy-duty and specially-engineered equipment group, which includes the Automation, packaged Drive & Control Centers, and Crane & Mill Accessory Controls Divisions. For the Standard Products, Renewal Parts, and American Electric Switch Divisions, B. H. Carlisle has been named general divisional manager.

Southern States expands in Georgia

SOUTHERN STATES Equipment Corp., of Hampton, Ga., has announced the beginning of an expansion program that will cost more than a quarter of a million dollars. The company manufactures a line of group operated air switches, disconnects, power fuses, cutouts, connectors, substations, and related products.

W. C. Mitchell, vice-president, pointed out that this is the second major expansion program undertaken in the past five years and much of the preliminary work is in progress.

Included in the new facilities for the Hampton plant will be a modern steel and masonry structure of approximately 25,000 square feet. The addition will join the structure completed in 1953 and will provide needed assembly and manufacturing space. The program is scheduled for completion in six months and will include enlargement of office and cafeteria space, a larger and more convenient parking area, and a new rail and truck entrance.

Manufacturers appoint new representatives

BERKO Electric Manufacturing Corporation announced recently the appointment of H. M. Summerell as its representative in Virginia, to service its contractor and distributor trade with sales and surveys at the point of contact.

* * *

WARD LEONARD Electric Company has appointed Roger W. Allen, 100 Peachtree St., NE, Atlanta and J. J. Galleher, 617 Cleveland St., Clearwater, as its sales representatives in Georgia and Florida, respectively. Mr. Allen and Mr. Galleher were formerly associated with C. B. Rogers and Associates, Atlanta. Mr. Rogers, whose company has represented Ward Leonard for the past seventeen years, has retired but will continue as a consultant.

* * *

SIERRA ELECTRIC Corporation has selected R. J. Laubersheimer, Jr. to represent their line of wiring

R. J. Laubersheimer

devises and wall plates in Louisiana, Mississippi, and Arkansas.

* * *

ACCURATE Manufacturing Company has named the Robert L. Haizlip Company, of Kansas City, Kan., as agents to cover Kansas and Western Missouri.

W. H. Lassiter Sales Co., of Charlotte, N. C., was appointed agents for both North and South Carolina. Both companies will carry a complete line of friction, rubber, and plastic electrical tapes.

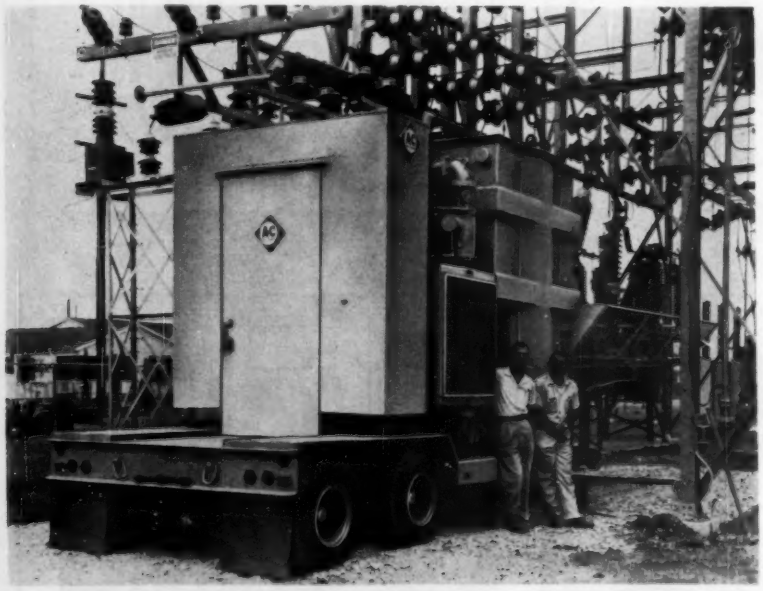
* * *

THE FRANK ADAM Electric Company has announced the appointment of H. E. Bracke and Company as their representative in Covington, Ky. James Meece becomes the Frank Adam representative in Dallas, replacing the late Paul Michler.

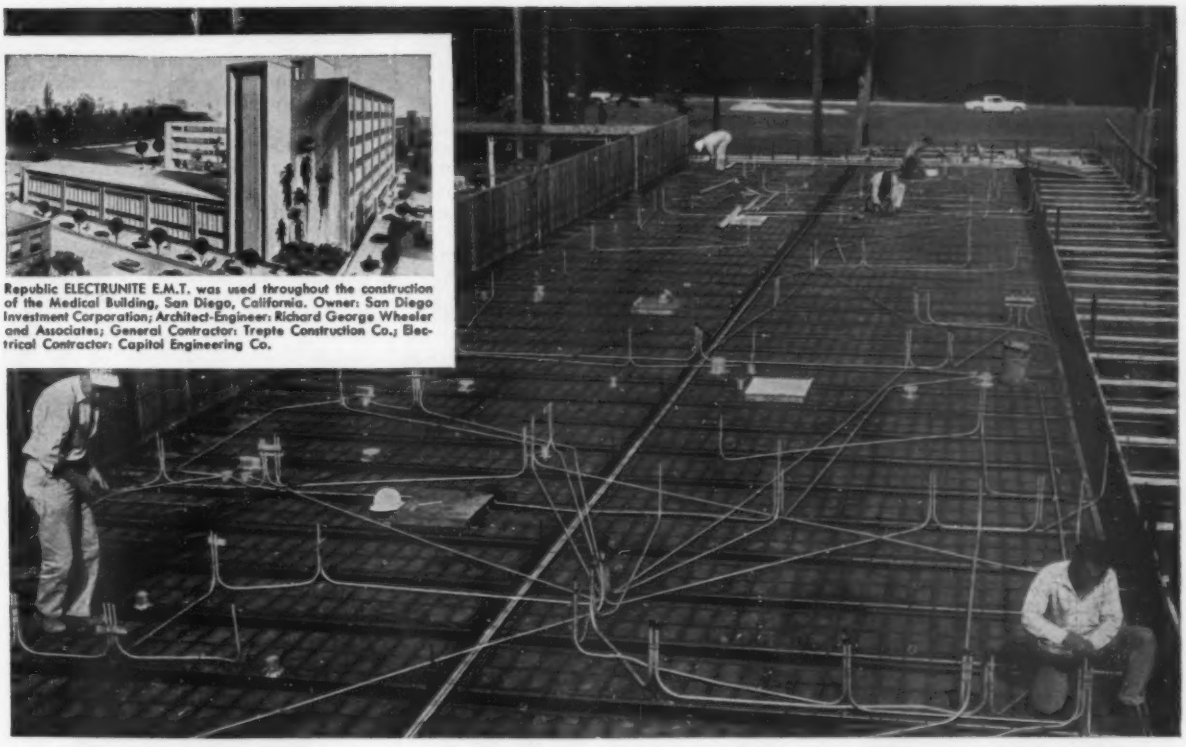
* * *

ALLIS - CHALMERS Industries Group has made the following new appointments: The Electric Supply and Equipment Co., Inc., 1812 E. Wendover Ave., Greensboro N. C., will serve as agency for feeder voltage regulators, power transformers, unit substations, switchgear and circuit breakers.

Sies Electric Supply Co., 734 East Eleventh St., Chattanooga, Tenn., becomes an agent for regulators while the L. R. Reams Supply Co., E. Cumberland at 13th St., Middlesboro, Ky., will distribute A-C motors, control and Texrope V-belt drive equipment.



MOBILE SUBSTATION SERVES TEXAS UTILITY—This 7500 kva, 69 kv mobile substation is shown in service during installation of 750 kva regulators on 12.5 bus at main substation of Community Public Service Co., Texas City, Tex. The three-phase mobile substation transforms required voltages through a series-multiple, delta-star switching arrangement. Heat exchangers consist of oil pumps for forced-oil cooling and fans for airblast cooling. The Allis-Chalmers unit is complete with internal high and low voltage switches, and is oil insulated.



Republic ELECTRUNITE E.M.T. was used throughout the construction of the Medical Building, San Diego, California. Owner: San Diego Investment Corporation; Architect-Engineer: Richard George Wheeler and Associates; General Contractor: Trepte Construction Co.; Electrical Contractor: Capitol Engineering Co.

Republic ELECTRUNITE E.M.T.... quality controlled from ore to job site... is the reason why THE BEST COSTS LESS INSTALLED

BEST . . . *because* bending quality is built in! Republic ELECTRUNITE® E.M.T. is produced from highest quality flat-rolled open-hearth steel made in Republic's own mills and carefully inspected to Republic's rigid requirements.

BEST . . . *because* the accurate ELECTRUNITE process insures tubing on which fittings fit every time, and "time means money" to every contractor.

BEST . . . *because* Republic's "INCH-MARKED" and "GUIDE-LINED" ELECTRUNITE E.M.T. offers greater installation economies. INCH-MARKED® . . . easy to measure! "GUIDE-LINED" . . . keeps bends in line. "INSIDE KNURLING" . . . for easy wire pulling.

Send coupon today for additional information, or call your Republic ELECTRUNITE distributor.

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World's Widest Range of Standard Steels and Steel Products

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Please send additional Republic ELECTRUNITE E. M. T. "INCH-MARKED", "GUIDE-LINED" information.

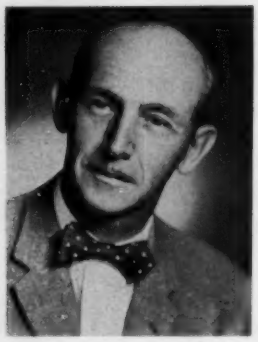
Name_____ Title_____

Firm_____

Address_____

City_____ Zone____ State_____

PASS & SEYMOUR, Inc., has announced the appointment of two new district representatives for



Ted G. Huttlemaier

the Texas area. Ted G. Huttlemaier will serve in the North Texas-Oklahoma territory with

Rudolph E. Neal

headquarters in Dallas. Rudolph E. Neal, operating out of Houston, has been assigned to South Texas.

* * *

ALLIS-CHALMERS has appointed a new regulatory agency and a new transformer distributor for areas in the South. Baird Electric Co., 1100 Demonbreun Viaduct, Nashville, has been named an agency for Type JFR A-C regulators in Western Tennessee.

The Lighting Fixture and Electric Supply Co., 307 Tchoupitoulas St., New Orleans will serve as distributor for transformers in the New Orleans industrial trading area.

Southerners named Fellows of AIEE

SEVERAL Southerners were included among the 15 members of the American Institute of Electrical Engineers who were elevated to the grade of "Fellow," the highest membership grade of the Institute.

AIEE, with a membership exceeding 50,000, is the world's largest engineering society. It awards the grade of Fellow to members who have served with distinction in the electrical engineering profession. Engineers from the South who were thus honored are:

George W. Bean, chief engineer, Texas Electric Service Company, Fort Worth, Tex., "for engineering achievements and administrative ability in the design and building of a rapidly expanding far-flung power system."

Robert S. Cannon, supervisor of engineering and construction, Plantation Pipe Line Company, Atlanta, Ga., "for important contributions in the application of advanced electrical systems to all phases of refined petroleum product pipe line operations."

Edward N. Dingley, Jr., staff research engineer, Electronic Communications, Inc., St. Petersburg, Fla., "for his many contributions in the field of electrical engineering to the defense of the United States."

News about people

Belcher and Associates, Inc., manufacturers representatives for electrical production, transmission and distribution equipment lines, has named **C. G. "Chet" Anderson** as branch manager in St. Petersburg, Fla.

Chet Anderson is an electrical engineering graduate of Purdue University. He was formerly associated with Allis-Chalmers Manufacturing Company and S & C Electric Co., and for eight years he operated his own sales agency in Chicago.

M. F. Knaus, president, has announced the appointment of **C. W. Sward** as executive director of the **Electrical Equipment Representatives Association,** to succeed **F. E. L. Whitesell,** who recently passed away in Winter Park, Fla.

Cy Sward retired in 1957 as vice-president of G & W Electric Specialty Company. His address is now 1675 Fifth St., Clermont, Fla.

C. T. Brasfield, Jr., who has been executive engineer since 1954, has been named manager of employee relations at **Alabama Power Co.**

Mr. Brasfield, a native of Mississippi and a graduate of the Georgia School of Technology, was employed as a junior engineer in 1924. He has held the positions of distribution engineer, supervisor of service, superintendent of miscellaneous operations, assistant to the operating manager and assistant to the general manager.

Herbert L. Branan has been elected a vice-president of the **Oklahoma Gas and Electric Company.** Donald S. Kennedy, president and chairman of the company's board of directors, announced recently.

Mr. Branan, who has been a member of the company since 1944, was elected at a recent meeting of the company's board of directors. In his new official capacity, he will con-

Herbert L. Branan

tinue to handle municipal and legislative matters dealing with the company and the electric industry.

Mr. Branan is a 1938 graduate of the University of Oklahoma Law school.

He joined OG&E as a special attorney in 1944, and during the past few years has devoted a great deal of his time to the company's municipal relations and franchises. He was elected assistant to the president in May, 1955. He is also past-president of the Arklahoma Corporation, an organization owned by three electric utility companies for the interchange of electric power.

Two new appointments were recently announced by **Percy Bugbee,** general manager, of the **National Fire Protection Association.**

Frank Stetka has been named elec-

trical field service engineer. He succeeds the late Charles L. Smith. Mr. Stetka will have offices in the Chicago headquarters of the International Association of Electrical Inspectors.

Mr. Stetka has been serving as a supervisory electrical engineer in the federal government's General Services Administration since 1956. Before that he was chief electrical inspector and assistant chief of the Field Inspection Branch for the District of Columbia.

As NFPA field service engineer, he will be secretary of the Electrical Section, secretary of the NFPA Electrical Correlating Committee, and National Electrical Code consultant to the International Association of Electrical Inspectors.

Richard E. Stevens was appointed an assistant technical secretary of the National Fire Protection Association.

Mr. Stevens has been serving as an engineer on the NFPA staff. He joined the organization in 1950. He was graduated from Tufts University with a degree of B.S. in mechanical engineering.

William P. Lowell, Jr., manager of commercial engineering and quality control for the Lighting Division of **Sylvania Electric Products, Inc.,** has been elected president of **RLM Standards Institute, Inc.,** after serving as vice-president for two years. He has served several years on the Institute's board of trustees.

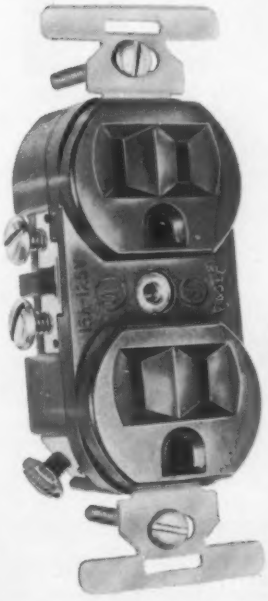
Mr. Lowell had the distinction of being selected to attend the recent International Electrotechnical Commission meetings in Moscow this past summer as the official representative of the American lighting and lamp industries.

William P. Lowell, Jr.

A graduate of Massachusetts Institute of Technology, Mr. Lowell joined Sylvania's predecessor company, The Hygrade Lamp Company, in 1929. During his 28 years with Sylvania, he has been engaged in virtually all phases of the lighting industry—from the life testing of incandescent lamps to the design of fluorescent lighting fixtures.

The World's MOST COMPLETE LINE EAGLE Quality ELECTRICAL WIRING DEVICES

WE KNEW IT WAS GOOD— BUT YOU TOLD US HOW GOOD!



EAGLE PARALLEL GROUND DUPLEX RECEPTACLE

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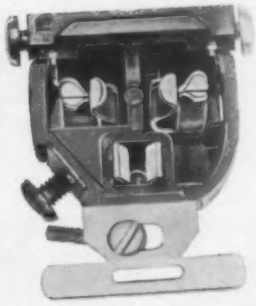
DOUBLE WIPE, PHOSPHOR BRONZE "T" CONTACTS

Proves to be Industry's Finest!



FIRMEST, MOST RIGID DOUBLE WIPE CONTACTS EVER MADE!

Retain excellent contact after 6,000 test insertions.

Cat. No. 827B—Brown
Cat. No. 827V—Ivory
15A-125V

UNDERWRITERS' LISTED • CSA APPROVED

Never before a parallel ground receptacle that was acclaimed like this one. Unsolicited letters praising it for eliminating callbacks, and ever increasing orders keep pouring in.

FEATURES THAT ELIMINATE CALLBACKS— SAVE INSTALLATION TIME

★ Solidly built phosphor bronze contacts are virtually indestructible. They keep firm, proper contact the life of the receptacle. Tests prove it.
★ Convenient "breakoff" feature provides 2 separate circuits, if desired. Easy wiring holes speed installation.
★ Larger head binding screws for modern wiring requirements—staked and backed out to save wiring time—take up to #10 wire.
★ Heavy yoke extends OVER ENTIRE BACK of receptacle. Sets better in box, will not loosen—no matter how rough the handling.
★ Parallel slots are polarized—and accommodate both regular and polarized 2 wire caps.
★ For use on 125 volt grounding systems, with equipment made in accordance with the new National Electrical Code.
★ Grounding may be accomplished through strap or through hexagonal green grounding screw.
★ Modern design, no grooves to catch dust. Sturdy Bakelite body to meet today's heavy electrical demands. ¾" long mounting screws attached to strap.

STOCK IT—SHOW IT—CASH IN ON THE DEMAND.
SOLD THROUGH WHOLESALERS ONLY. WRITE FOR FREE SAMPLE.

EAGLE ELECTRIC MFG. CO., INC.
LONG ISLAND CITY 1, NEW YORK
"PERFECTION IS NOT AN ACCIDENT"

Appointment of a new sales district manager, and transfer of another, were announced recently by **D. B. Clark,** Southern sales region manager for the **General Electric** Large Lamp Department.

Harry W. Bourgeois as a new manager, assigned to Delta Large Lamp sales district, with headquarters at New Orleans, La.

Gordon E. Brown, former manager of Delta sales district, as manager of South Central sales district, with headquarters at Memphis, Tenn. Brown replaces the late **George W. Ellis.**

John M. Gray has been assigned to the Southeast Region of **Allis-Chalmers Industries Group** as a serviceman.

William N. Caldwell, who had been a serviceman in the company's Southeast Region, has been assigned to the Tampa district office as a sales representative. He is a graduate of the University of Alabama.

G. Mayne Daly has joined the **A. B. Chance Company** sales organization as product distribution manager according to an announcement by **L. C. Hansen,** marketing director.

Mr. Daly was formerly associated with the Oliver Electric Manufacturing Company and Oliver Iron and

G. Mayne Daly

Steel Corp. His major responsibility with the Chance Company will be to improve product distribution and service to customers.

New executive assignments at the policy, administrative and operations levels of the **Westinghouse Electric Corporation,** have been announced by **Gwilym A. Price,** chairman and president, following a regular meeting of the board of directors.

Mr. Price, who has been president since 1946, and chairman since 1955, becomes chairman of the board.

Mark W. Cresap, Jr., executive vice-president and a director since 1955, was elected president, and chief administrative and operating officer.

E. V. Huggins, who has been vice-president-corporate affairs and corporate secretary, becomes chairman of the executive committee of the board of directors and vice-president.

John K. Hodnette, vice-president and general manager and a director of the company since 1955, was elected executive vice-president.

George G. Main, treasurer since 1949, retains that position and becomes also vice-president-finance.

Francis E. Dalton, director, corporate accounting since 1949, was elected controller.

Carlisle P. Myers, general counsel since 1955, retains that position and was elected corporate secretary.

Russell B. Read, planning director since 1952, will continue in that assignment and was elected assistant treasurer.

R. S. Mills has been appointed sales manager of the Underground Fittings Division of **Anderson Electric Corporation,** in Birmingham, Ala., according to a recent announcement by C. E. Bitzer, vice-president in charge of sales.

Mr. Mills joined Anderson Electric as sales application engineer in the Substation and Transmission Division. He is a graduate of the Uni-

R. S. Mills

versity of Alabama with a BS Degree in Industrial Engineering and was formerly with The Birmingham Transit Company and The Virginia-Carolina Chemical Corp.

Two new sales appointments were recently announced by **George C. Price,** president, of **Oliver Electrical Manufacturing Co.**

C. R. (Ray) Dudley was named general sales manager. Mr. Dudley's many years with the company include recent positions as manager of

There are PLUS VALUES for YOU in the PAINE line of Hanging and Fastening Devices:

ONE SOURCE. Saves you time, inventory and freight costs.

TOP QUALITY and job-right design make satisfied users.

GOOD PACKAGING — Strong, colorful cartons, clearly labelled.

CUSTOMER DEMAND stimulated with attention-getting ads like this ➤

Hang Fixtures Faster and Easier with the PAINE Outlet Box and FIXTURE HANGER

One of the easiest to install and most serviceable hangers ever designed. Solves the problem of hanging fixtures and outlet boxes to ceiling or wall surfaces where you can't reach the other side. Simply insert thru hole — as small as 1⅛" in diameter — and wings drop flat, locked in place by a patented key. To release wings for removing hanger at any time, just raise key with screw driver inserted thru nipple. Try these hangers once and you'll use them again and again.

Write for Catalog of Paine's complete line.

the best craftsmen always take PAINE'S

THE PAINE COMPANY, 21 Westgate Road, Addison, Illinois

Ray Dudley

Southeastern District Sales, Southwestern District Sales, and for all sales in the Southern area.

Earl B. Page

Earl B. Page becomes Southwestern District Sales Manager with headquarters at Oliver's new warehouse, 1710 Levee St., Dallas, Texas.

Warren S. Jones, Dallas district sales representative for the **Rockbestos Products Corp.,** has been appointed assistant to Sales Manager Richard H. Bamford. Mr. Jones attended Cheshire Academy, New Haven Junior College, and has done graduate work in engineering at various colleges.

Mr. Jones will be succeeded in Dallas by **William C. Crymes,** formerly components and standards analyst engineer for Chance Vought Aircraft, following fifty-four months of technical training with the U. S. Air Force. He attended the University of Georgia before entering military service.

Arthur F. Uhrlandt has been appointed to the newly created post of director of field sales for **Crouse-Hinds Company,** Syracuse, as announced by John R. Tuttle, president and chairman of the Board. Mr. Uhrlandt, with an extensive background of 27 years' sales experience in the electrical field, will direct and coordinate all activities of the Crouse-

New Revere Fluoresign Outdoor Luminaire

Now—high level illumination for poster panels, walls

Better light distribution, simplified installation, and flexibility to fit any display are three good reasons for specifying Revere's Fluoresign Outdoor Luminaire.

Fixtures employ fluorescent rapid-start lamps which provide 10 times the rated life of incandescent types . . . plus greater operating economy for low temperature outdoor use. New reflector design minimizes trapped light, and provides uniform light distribution.

Lightweight aluminum reflectors of 4, 6 and 8 feet may be assembled with end and center housing fixtures to any desired display length. Reflectors rotate in any direction — within full 360° — by simple screwdriver adjustments.

Write for complete bulletin No. 300-21 describing Revere's Fluoresign Outdoor Luminaire.

Revere ELECTRIC MFG. CO.

Revere Electric Mfg. Co.
6009 Broadway, Chicago 40, Ill.
UPtown 8-7100

Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario

OUTDOOR LIGHTING: Industrial, Commercial, Service Stations, Streets, Sports, Airports, Shopping Centers

Hinds' eleven field sales divisions.

Prior to joining the sales staff of Crouse-Hinds' Chicago Division in 1942, Uhrlandt was associated with Westinghouse Electric Corp., Westinghouse Electric Supply Co., and the Niagara Mohawk Power Corp.

Henry Gluck has been named vice-president in charge of sales for the **Sunbeam Lighting Co.**, according to a recent announcement by Herbert L. Krieger, president. Mr. Gluck will be in charge of all sales and distribution activities of the organization, including the network of company-appointed local area sales representatives.

Further responsibilities include coordination and administration of eastern and western operations at design, development, manufacturing, and marketing levels. Mr. Gluck joined the national manufacturer as sales manager last spring, prior to the firm's acquisition of a 4½ acre plant at Gary, Ind.

At a recent meeting of the board of directors of the **Royal Electric Corporation,** manufacturers of wire, cable, fuses and wiring devices, **Max Alperin** was elected chairman of the board and chief executive officer.

Mr. Alperin has been with the Royal organization for over thirty years, and holds the distinction of more years of service than any other employee, starting shortly after the founding of the company in Boston. He moved to Pawtucket, Rhode Island when Royal established its first plant there.

He has served in many positions and capacities, including vice-president, and most recently as executive vice-president and general manager. He has been a member of the board of directors for many years.

The Electrical Conductor Division of Kaiser Aluminum has announced the appointment of **Cecil R. Pickens** as insulated cable engineer at the division's sales headquarters in Chicago. He had been regional manager for insulated products in Atlanta.

At the same time, **Gerald H. Redden,** formerly of the Chicago office, was named salesman for electrical conductor products in the Atlanta district.

Mr. Pickens joined Kaiser Aluminum in early 1957 when the firm acquired the Wire and Cable Division of United States Rubber Company. He was with U. S. Rubber for eleven years holding numerous sales and engineering positions in Atlanta and Southeastern states. Mr. Pickens received his BS degree in electrical engineering from the University of Alabama.

Cecil R. Pickens

Mr. Redden joined Kaiser Aluminum & Chemical Sales, Inc., in 1955 and served as an engineer in Chicago prior to his recent appointment. He is an electrical engineering graduate of Tennessee Polytechnical Institute and has held engineering positions with Warren Rural Electrical Cooperative Corp., Fleming and Patterson, Meriwether Lewis Electric Cooperative, and Morristown Power System.

G. H. Redden

R. E. Morris has been appointed manager of the St. Louis District of **Allis-Chalmers Industries Group,** succeeding **J. C. Lovelace,** who has resigned.

Most recently manager of industrial sales in the Washington, D. C., office, he was previously a sales representative in the Washington office for seven years. Prior to that he has been associated with the Charlotte district office. Mr. Morris is an electrical engineering graduate of Georgia Institute of Technology.

Latrobe PRODUCTS

FLOOR BOXES • WIRING SPECIALTIES

Adjustable Watertight Floor Boxes

All adjustable boxes are now equipped with a positive bond which makes them completely fire-proof.

"Latrobe" Floor Boxes and Wiring Specialties are top performers because they are expertly designed of the finest materials.

"Latrobe" Products are proof that the shortest road to efficiency and economy lies through quality.

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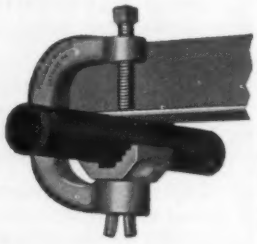
The most economical and best pipe hanger sold today — rust-proof.

For hanging pipe ½" to 1½" thick to steel beams ⅜" thick.



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Technical books

Protective relaying

"Applied Protective Relaying." Published by Westinghouse Electric Corp., (Write to Technical Information Dept.) P. O. Box 2278, Pittsburgh 30, Pa., 239 pages, $3.00.

This basic text for class or individual study in the application, setting, and maintenance of protective relay systems is designed to be equally useful to practicing relay engineers and to engineers who are indirectly concerned with relay systems; it is the outgrowth of classes taught for several years by Westinghouse engineers. Emphasis throughout is on relay applications and not on relay design.

Chapter headings of the new book are: Introduction and General Philosophy; Technical Tools of the Relay Engineer— Phasors, Polarity, and Symmetrical Components; Instrument Transformers for Relaying; Generator Protection; Motor Protection; Transformer Protection; Station Bus Protection; Line Protection; Pilot Protection; System Stability, Reclosing and Synchronizing; Line Protection for Multiterminal and Tapped Lines; and Testing and Maintaining Protective Relays. A 21-page appendix contains much useful relay engineering data.

Code handbook

Abbott's "National Electrical Code Handbook," Ninth Edition, revised by Charles L. Smith. Sponsored by the National Fire Protection Association. Published by McGraw-Hill Book Co., 327 West 41st St., New York 36, N. Y., 664 pages, 394 illustrations, $8.00.

The many former editions of this book have kept electrical workers reliably informed on the meaning and intent of the various rules of the National Electrical Code. Now modernized, this newly-published edition explains the latest, revised Code rules in brief, easy-to-understand language.

The handbook gives the general plan, scope, and intent of Code requirements, and discusses them in simple fashion to aid electrical contractors, electricians, and others in making and planning electrical installations that are in conformity with the National Electrical Code.

In this ninth edition are all the changes reflected in the 1956 Edition of the Code. These cover im-

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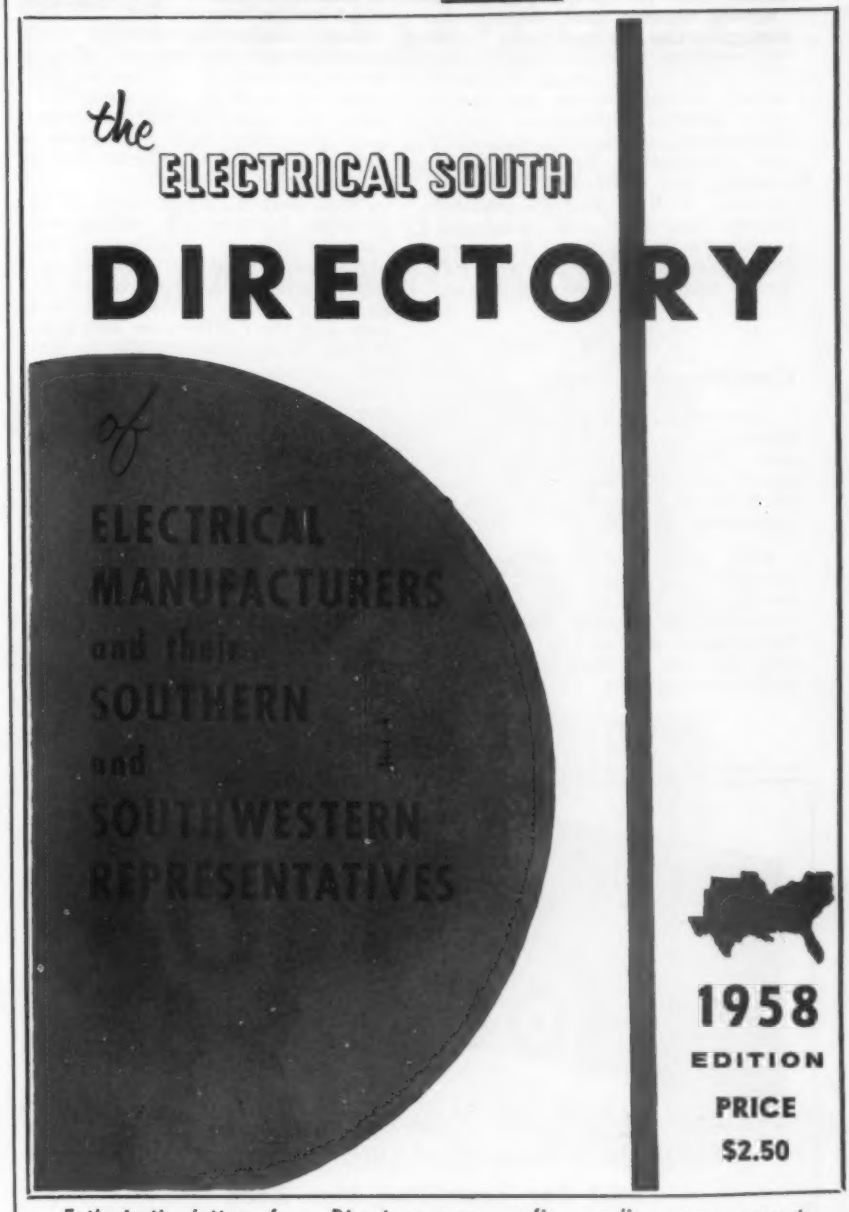

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portant changes regarding branch circuits, number of receptacles in dwellings, new recommendations for service entrance cable, overcurrent protection and much more.

The complete contents cover rulings for wiring design and protection, wiring method and materials, general equipment, public occupancies, special equipment and conditions, communications systems, and construction specifications. A final section includes tables, diagrams, and examples, together with an appendix clarifying procedure rules on the National Electrical Code Committee.

Construction costs

"Electrical Construction Cost Manual," By Ralph Edgar Johnson. Published by McGraw-Hill Book Co., 327 West 41st St., New York 36, N. Y., 448 pages, 227 illustrations, $10.00.

This newly-published manual presents a practical method for making accurate cost estimates of electrical construction work—and for bringing all the vital cost factors of a job together in an integrated cost system.

In clear, logical steps it (1) establishes fundamental methods for installing electrical work in various types of construction; (2) develops standard assemblies, such as housings, terminals, and panelboards, for these various conditions; (3) sets up unit costs covering the material and labor for each assembly; and (4) gives a detailed estimating procedure for applying the unit costs.

This helpful guide also gives methods for take-off, pricing, and summarizing the estimate. Included is a practical plan for applying overhead, and charts for applying profit. Various job factors, and their effects on cost estimating, are fully explained. Recent advances in electrical construction, such as low voltage switching and various types of wiring, are covered in the book.

The book treats material identification in a helpful manner, including classification, numbering, abbreviations, and material release procedure.

Many clear drawings illustrate fundamentals of installing electrical work, and show the assemblies which form the nucleus for unit costing. All methods and procedures are demonstrated by means of practical, realistic examples.

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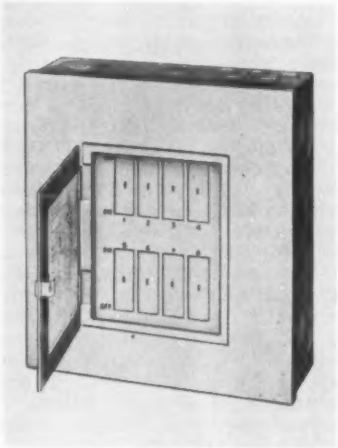
(February 1958)

New products

Indoor or outdoor 100 ampere circuit breaker load center

THE WADSWORTH Electric Mfg. Co., Inc., of Covington, Ky., has introduced a new circuit breaker load center designed to take the E-Z Red circuit breakers of 15 to 20 amperes, single and double poles, or 15 to 20 ampere switching neutrals for gas stations.

The enclosure is available in either the indoor (surface and flush) or outdoor type for six or eight circuits. With Wadsworth sequence buss



design and two adjacent breaker positions may be double pole, the maximum combination of the six circuit load center will take one to six single pole breakers or three double pole and the eight circuits will take one to eight or four double pole breakers. The enclosure is for 3 wire service, solid neutral 100/240 volts a-c.

For additional data, ask for item P-214, using the coupon on page 99.

Toggle action operation on manual starter line

A COMPLETELY new line of Class 2510 integral horsepower manual starters, in NEMA Size 0 and 1, for control of motors up to 7½ hp, is available from the Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.

New design features a heavy-duty, toggle action operating mechanism which gives positive snap-action opening and closing of the contacts, with no dead center position.

Trip-free overload protection is provided by melting alloy type relays of Square D unit construction. Self-centering pushbuttons give visual indication of an overload condition.

Rated up to 600 volts a-c or 250 volts d-c, these starters are available

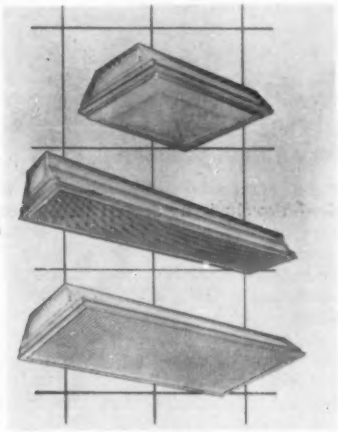
in compact 2-, 3-, or 4-pole construction. In addition to an open-type version, a complete line of newly styled enclosed models is offered to meet a wide range of application requirements.

For additional data, ask for item P-215, using the coupon on page 99.

100 recessed fixture types from three troffer sizes

THE VERSALINE-GRID recessed troffer line just announced by the Miller Co., 99½ Center St., Meriden, Conn., features lighting versatility assured by 100 fixture types from just three sizes. The fixtures are designed especially for use in exposed T furring and Acousti-Line ceilings and are ideal for lighting stores, offices, schools and public buildings.

The versatility of size, closure, and lighting level satisfies a wide variety of visual, structural and esthetic re-



quirements making it possible to plan an entire installation by selecting the most suitable units for each area.

Sizes available are 1′ x 4′, 2′ x 4′ and 2′ x 2′. The 1′ x 4′ offers a choice of 2 or 3 lamp units. In the 2′ x 4′ and 2′ x 2′ sizes, 2, 3, or 4 lamp units are available. Eight modern shielding closures are offered.

For additional data, ask for item P-216, using the coupon on page 99.

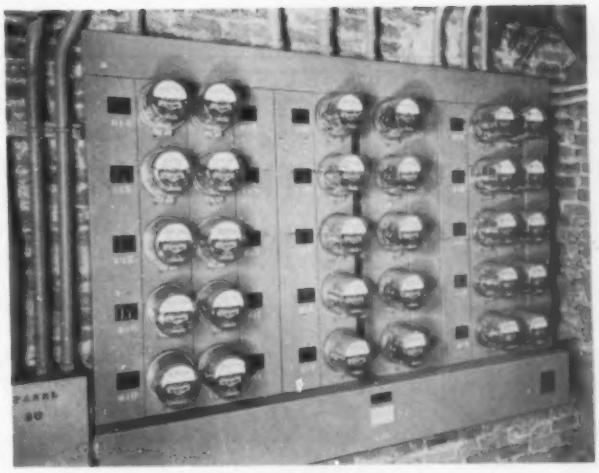
Adjustable counter ring on new porcelain socket

A PORCELAIN SOCKET with an adjustable counter designed to provide

ANCHOR

FOR DESIGNERS OF OFFICE BUILDINGS APARTMENT HOUSES

BEFORE



AFTER

The above are actual photographs of part of a Meter Room which was recently modernized by installing Anchor meter channels. These combine the meter mountings and main breakers for each apartment in one factory wired compact assembly.

Bulletins on request

ANCHOR MANUFACTURING CO.
MANCHESTER, NEW HAMPSHIRE

an economical, quick and easy method of attaching glass or plastic gloves and shades to metal lighting fixtures had been introduced by Circle F Manufacturing Co., Tyler and Monmouth Sts., Trenton, N. J.

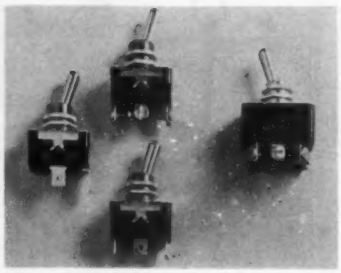
The new adjustable counter ring porcelain socket eliminates the need for the normally employed holding screws and time consuming threaded assemblies. It permits fixtures to be shipped unassembled, which reduces breakage in transit and enables the consumer to replace broken globes without disassembling the fixture.

For additional data, ask for item P-217, using the coupon on page 99.

Single and double pole a-c toggle switches

A NEW LINE of circuit control a-c toggle switches has been announced by Leviton Manufacturing Co., 236 Greenpoint Ave., Brooklyn 22, N. Y. These toggle switches have ratings of 15 amperes, 125 volts a-c and 10 amperes, 250 volts a-c as listed by Underwriters' Laboratories, Inc.

The new 5700 line is indicated for ¾ hp motors at 120 volts to 240 volts a-c. This series presently includes eighteen different types of switches consisting of single pole and double pole—each respectively in single throw, double throw and double



throw-center off, as well as choice of either solder lugs, quick connect tabs or terminal screws.

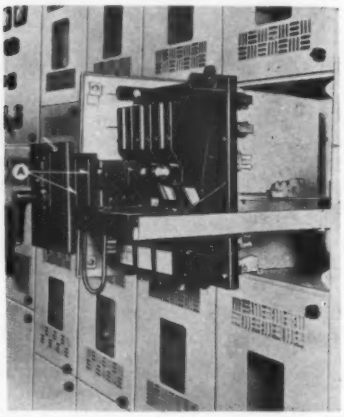
For additional data, ask for item P-218, using the coupon on page 99.

Air circuit breaker with three positions

A NEW (Type DB) 600-volt, 15- to 4000-amperes, metal-enclosed switchgear with three-position breaker design is now available from the Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa. The interrupting ratings of the units are from 15,000 to 100,000 amperes.

With the circuit breaker in any of its three recognized positions—connected, test and disconnected—the door of the breaker compartment can be closed. Indication of the breaker position is provided by two white lines on the mechanism.

When both lines show, the breaker is in the disconnected position with both primary and secondary contacts disconnected. When one line is visible, the breaker is in the test position



with primary contacts separated but the secondary contacts engaged for test purposes.

When neither line shows and the small faceplate is flush with the switchgear door, the breaker is in the connected position with all disconnecting contacts engaged.

The trip action on the DB-25 and DB-50 is now accomplished by a separate push button.

For additional data, ask for item P-219, using the coupon on page 99.

IT WILL COST LESS TO USE THE BEST WHEN YOU SPECIFY AND INSTALL . . .

AMERICAN *Bonded* ARMORED CABLE

A smart cable investment is one that performs equally well under any condition without failure. That's why American Bonded Armored Cable is a smart investment for the specifier, the contractor and the customer. There's built in toughness and long life in every inch of American Bonded, adding up to lower costs for a lifetime of job performance. It really costs less to use the best . . . to use American Bonded Armored Cable.

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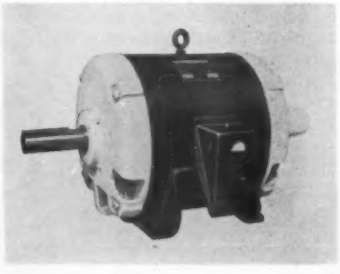
Houston Warehouse
PEABODY BROTHERS
240 Shea St.
Houston 2, Texas

Dallas Warehouse
PEABODY BROTHERS
3015 Taylor St.
Dallas, Texas

Electric pumping motor for oil field pumping

AN ELECTRIC pumping motor designed exclusively for oil field pumping has been announced by the Continental-Emsco Co., a division of Youngstown Sheet and Tube Co., Stambaugh Bldg., Youngstown 1, Ohio.

A pumper can see-at-a-glance if the well is pumping satisfactorily and economically. Uniform readings indicate no trouble, but the needle



peaking unevenly means something wrong, a parted rod string, an unseated pump, paraffin deposits or some other problem.

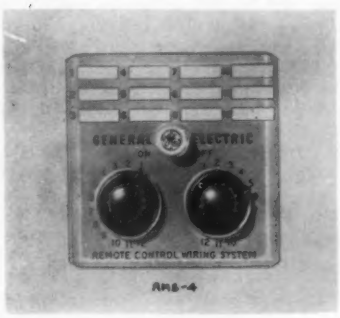
The balance meter gives an accurate gauge for balancing the well too,

and neither an engineer nor special electrical instrument are needed to check it. Green Triangle Electric Pumping Motors operate at 1200 rpm (synchronous) and are available in 3, 5, 7½, 10, 15, 20, 25 and 30 hp.

For additional data, ask for item P-220, using the coupon on page 99.

Master selector switch for low-voltage systems

A MASTER-SELECTOR switch produced by the General Electric Co., 95 Hathaway St., Providence 7, R. I., extends the usefulness of remote-control and other low-voltage wiring systems. The new switch controls up to twelve lights or outlets with two separate ON and OFF knobs. In addi-



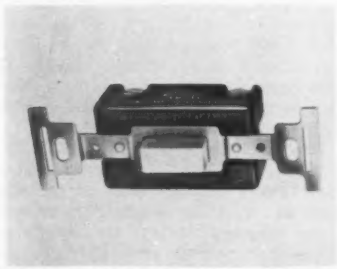
tion to extending the number of lights controlled from a single switch, the two knobs permit one-hand operation.

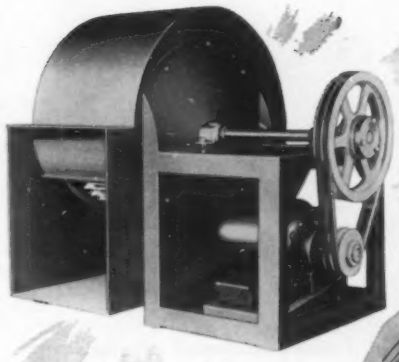
To select a particular light or outlet, either the ON or the OFF knob is rotated to the circuit number desired and then pressed to operate the low-voltage relay of the remote-control wiring system. For master-control of all twelve lights, the knob is first pressed and then rotated through all twelve position.

For additional data, ask for item P-221, using the coupon on page 99.

One-inch deep touch-type switch fits standard boxes

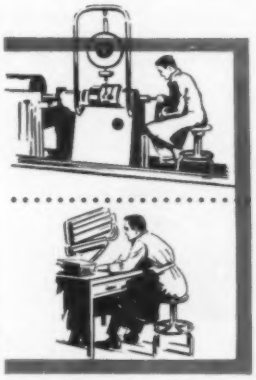
THE RODALE Manufacturing Co., Inc., 6th and Minor Sts., Emmaus, Pa., has announced their low cost, one-inch deep touch-type switch. The Model B Touchette allows for quick, simple installation even in boxes where several wires enter. With no





Peerless Belt Drive
Backward Curve Blower

Peerless Belt Drive
Centrifugal Roof Ventilator



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As a charter member of AMCA, we are naturally vitally interested in listing and rating our air moving products according to AMCA specifications as set forth in the AMCA code. The products you see here are the two most important, basic products in our expanded line of air moving equipment. Along with other Peerless air moving units, they have been designed and manufactured to meet all AMCA standards. With this assurance, Peerless air moving equipment can be specified and installed with confidence. When you have an air moving condition which needs solving, call your nearby Peerless representative or the Peerless factory direct. We can all work together in helping you arrive at the best possible solution.

Write today for Bulletins SDA-160, SDA-200, and SDA-220!

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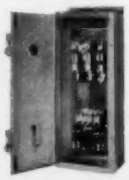
Peerless-Electric

SEE OUR CATALOG IN SWEET'S

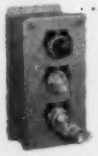
REDUCE COSTS WITH FURNAS ELECTRIC CONTROLS

Furnas Electric offers the RIGHT control for every job. Enjoy cost and space advantages by choosing the control designed for the motor.

Only Furnas provides a choice of 10 starters through Size 4, instead of the usual 5, to match the applications from 1 hp to 100 hp. All are UL listed. Exclusive "In-between" sizes give additional cost and space advantages.



Combination Starters —a single mounting plate containing magnetic starter and disconnect for economical installation. Combination unit is used for all types of enclosures as well as an open unit for panel mounting. All Furnas Combination Starter enclosures feature external mounting feet for simplicity and accessibility.



Push Buttons for every need —Standard, Heavy-duty and Oil Tight. Choice of either front or back mounting. Furnas standardization and interchangeability mean more variations with fewer parts. Complete accessory line.

Drum Controllers

Pressure Switches

Limit Switches

Foot Switches

For full information write for Catalog 5800, 1064 McKee St., Batavia, Ill. A39

FURNAS ELECTRIC COMPANY
BATAVIA, ILLINOIS
Sales Representatives in All Principal Cities

knob to turn, no toggle to flip, the Model B is the switch designed for today's push-button living.

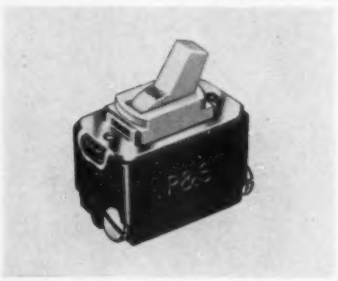
The Touchette needs no special wiring, it fits standard outlet boxes and toggle wall plates and operates on full line voltage. This switch is rated 15A-120-277v and withstands motor loads up to 80 per cent of rated capacity.

For additional data, ask for item P-222, using the coupon on page 99.

Totally enclosed plastic body on new residential switches

A COMPLETELY new line of modern AC Quiet Switches for residential use has just been introduced by Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y. The line includes a strap type for conventional installation and interchangeable P&S-Despard types for double or triple combinations.

All these switches feature compact, totally enclosed plastic bodies with ample wiring room. Each can be installed in any position. All are available in either brown or ivory. Designed for long life quiet operation, all P&S AC Quiet Switches are listed by Underwriters' Laboratories, Inc.



For additional data, ask for item P-223, using the coupon on page 99.

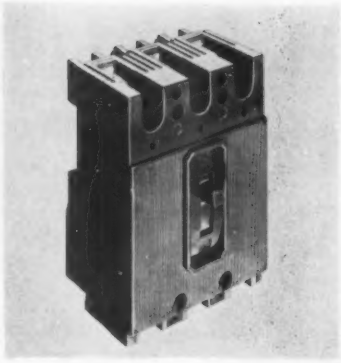
480 volt circuit breaker saves mounting space

AVAILABILITY of a new, compact 100 ampere molded case circuit breaker has been announced by the I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.

Designated the "EH" frame circuit breaker, the new design may be used in panelboards, switchboards, load centers, and all types of individual enclosures.

For 480 volt applications, the new "EH" frame breaker saves mounting space requirements by 40 per cent over the "F" frame, and is the same physical size as the "E" frame breaker.

Coordinated thermal-magnetic operating characteristics assures positive protection against overload and short circuit conditions. Common tripping, quick make-quick break operation and a three-position operating handle are a few of the design features incorporated into this breaker that assures dependable operation.



The "EH" frame breakers are available in 2 and 3 pole construction, 10 to 100 amperes continuous ampere rating, 480 volt a-c, 250 volt d-c, and an interrupting rating of 10,000 amperes. The breakers meet the requirements of Federal Specifications WP-131A as Class C1, C2, and C3 breakers.

For additional data, ask for item P-224, using the coupon on page 99.

Weatherproof duplex parallel ground receptacle

TO MEET the steadily mounting call for more adequate wiring devices to properly deliver electrical power outside the home, Eagle Electric Mfg. Co., 23-10 Bridge Plaza South, Long Island City, N. Y. introduces a new weatherproof duplex parallel ground receptacle.

This new weatherproof receptacle has a one-piece, single hinged, lip cover to assure extra protection against inclement weather.

After, use the stainless steel spring automatically locks the cast metal cover against the receptacle. A rubber weatherproof mat and self sealing rubber gasket help keep out dirt, dust, dampness, rain.

To completely eliminate the possibility of a short, there is no rim around the receptacle opening which can come in contact with the terminal screws on the plug.

For additional data, ask for item P-225, using the coupon on page 99.

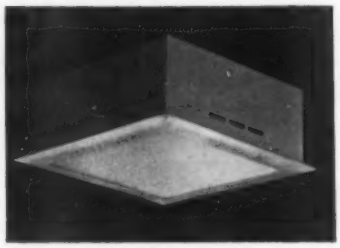
Oblong 100-watt recessed unit offers lighting flexibility

OBLONG 100 watt recessed lighting fixtures in a wide range of styles are one of the new features being offered by Atlas Electric Products Co., 319 Ten Eyck St., Brooklyn 6, N. Y. Each unit is produced with one piece steel frames without weld marks.

Key feature of the new Atlite line is flexibility. Units are designed to meet every requirement of installation as well as usage. Three separate housing styles are available; unwired, unwired with asbestos linings, and prewired. Light leakage is

eliminated by fibre glass gaskets.

Adding to the flexibility of the line is the variety of available lenses and finishes. Each unit can be had in chrome, copper or brass plate, grey or white paint, satin black anodized



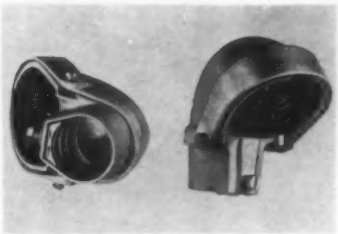
or satin aluminum anodized. Lens styles include Skytex, Fresnel, Ferlux, Alba, Drop Lens or bent lenses.

For additional data, ask for item P-226, using the coupon on page 99.

Entrance fittings reduce cost and expedite installations

GRIPTITE entrance fittings, introduced by Gedney Electric Co., of 1250 Avenue of the Americas, New York, N. Y., simplify, accelerate and reduce the cost of installation for electricians and contractors.

Novel construction permits conduit



to be slipped into the fitting easily and without threading. Only a screwdriver is needed to tighten the inner shoe on conduit or tube.

For additional data, ask for item P-227, using the coupon on page 99.

Threading tool capacity increased

ADDITION of a new Ratchet Stock of increased capacity to its line of pipe threading tools is currently being offered by the Nye Tool Co., Dept. ES, 4126 W. Fullerton Ave., Chicago 39, Ill.

The No. 12 triad stock is designed to include a pipe threading range of 1½ inches through 2 inches, and in this respect is being offered as a supplement to the Nye Triad No. 60.

For additional data, ask for item P-228, using the coupon on page 99.

Free bulletins

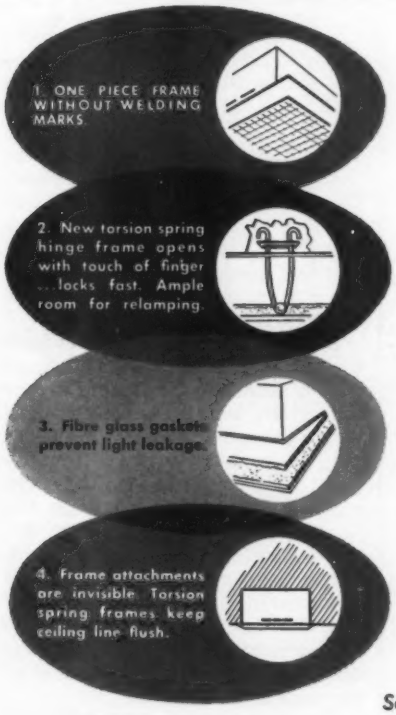
Weston Electrical Instrument Corp., Newark 12, N. J., has announced availability of a new bulletin describing its group of **long scale panel meters** for specialty applications.

For additional data, ask for item B-229, using the coupon on page 99.

Complete information on **Kyle Type R and W reclosers** is furnished in Catalog Bulletin CR1CA obtainable from **Line Material Industries,** Milwaukee 1, Wis. Described are application, operation, features, and ratings of the various devices. Typical control schemes are also included.

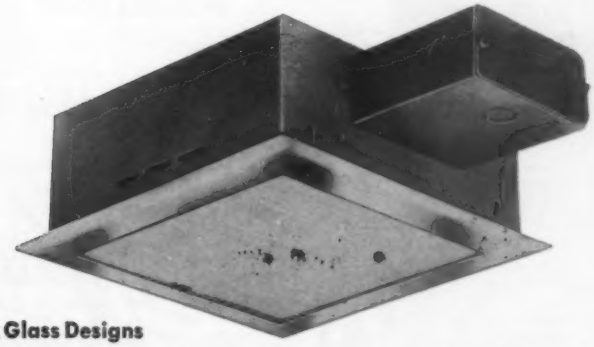
For additional data, ask for item B-230, using the coupon on page 99.

Catalog 58E — available from **The Fast Lok Mfg. Co.,** Ash Street at Bedford, Bridgeport 5, Conn. — shows the complete line of **time-saving products for the electrical contractor,** for industrial, residential, and commercial construction. Included are illustrations, diagrams, and specifications


1. ONE PIECE FRAME WITHOUT WELDING MARKS.
2. New torsion spring hinge frame opens with touch of finger ... locks fast. Ample room for relamping.
3. Fibre glass gasket prevent light leakage.
4. Frame attachments are invisible. Torsion spring frames keep ceiling line flush.

advanced recessed lighting by ATLITE

Superior lighting design and construction plus low cost make Atlite the value line in recessed fixtures.



Six Glass Designs

Seven Finishes—Chrome...Copper...Brass...White...Grey
Satin Aluminum Anodized...Satin Black Anodized

Send for NEW ILLUSTRATED CATALOG of the complete ATLITE line.

Atlite "The Line With Light Appeal"

ATLAS ELECTRIC PRODUCTS CO. 327 Ten Eyck St, Brooklyn 6, N.Y.

Better installations in less time

Simple, quick to install

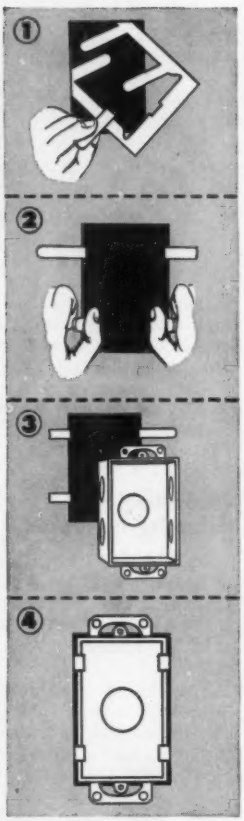
BLACKHAWK 540 BOX SUPPORT

stays rigidly in place

The Blackhawk No. 540 one piece box support slips into the wall opening and tabs are bent back to hold it in place. After the switch box is installed, the tabs are bent to the inside of the box squeezing it firmly in place. It's that simple and quick.

It makes a permanent installation because the Blackhawk 540 box support is a large single piece . . providing rigid, unified support. It does not wiggle or saw because it is parallel to the wall.

For simple, quick, permanent switch box installation, specify Blackhawk No. 540 box support. Ask your electrical distributor for Blackhawk.



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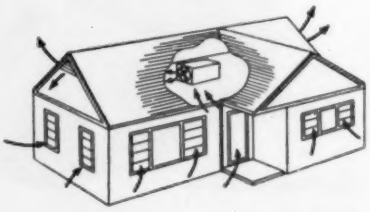
Be sure to have enough of these husky, quiet-running "BREEZ-AIR" ATTIC FANS for an all-time record season! Old homes, new homes all need this economical, dependable cooling. EASY to sell! Write for Bulletin FM-20, prices, displays, sales aids, simple installation diagrams. But don't offer less than "Buffalo" quality, backed by 81 years of user satisfaction. Write today—no time to lose!



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Sales Representatives in all Principal Cities
INDUSTRIAL EXHAUSTERS BELTED VENT SETS PROPELLER FANS
"E" BLOWERS-EXHAUSTERS

of adjustable bar hangers, conduit beam clamps, set-screw fittings, rigid upright box supports, single arm supports, and hung ceiling fixture supports.

For additional data, ask for item B-231, using the coupon on page 99.

A low-cost, **built-in home cleaning system** is described in a new four-page brochure issued by **Premier Co.**, 755 Woodlawn Ave., St. Paul 16, Minn. Typical home applications are illustrated and a schematic drawing shows how the system may be employed in a house for efficient and economical cleaning.

For additional data, ask for item B-232, using the coupon on page 99.

Know the law

(Continued from page 70)

terms of his lease to make alterations or improvements to the leasehold and the same is done by the lien claimant solely at the request of the lessee, no lien will be sustained upon the property of the lessor, and no notice of nonliability need be posted by the property owner."

The courts of most states would be apt to reach similar conclusions under their respective lien statutes.

Contamination

(Continued from page 50)

to the system neutral. When possible, the spray nozzle is operated at a distance of two feet or more from the energized conductors.

For most effective use, it is also desirable to have the wind blowing from the washer to the insulators to be washed. To reduce flashovers to a minimum, the washing operation progresses from the bottom of the insulator to the top.

Although we knew from tests that flashovers due to the use of City of Miami water would not be a problem, we discovered the hard way that such was not the case with the water from other municipalities. One afternoon, an operator, washing the lines in the northern end of the County, decided to save time by refilling with the water from a small nearby municipality. As soon as he started washing again that afternoon, we experienced a series of flashovers due to the high mineral content of the water.

We have found that with the washer contamination in areas exposed to salt spray can be satisfactorily controlled by monthly

ELECTRICAL SOUTH
806 Peachtree St., N.E.
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February, 1958

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Please send me additional information on items mentioned in this issue of Electrical South. I have listed the key numbers of these items at right.

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SOUTHERN

SHAL-O-LITE LUMINAIRE

This shallow luminaire may be used as an individual unit, in continuous rows, or arranged in various patterns. When surface mounted, the plastic side panels of ribbed, polished diffusing polystyrene illuminate the adjacent ceiling. The white translucent louver of molded ⅝" cubicles provides 42-degree shielding lengthwise and crosswise.

Available in two, four, or six lamp luminaries with Rapid start, Slimline, or starter type ballasts.

Remember, specify and satisfy with SOUTHERN fluorescent fixtures.

SOUTHERN LIGHTING MFG. CO.
502 ELWELL ST. **ORLANDO, FLORIDA**

Increase Your
EFFICIENCY!

with a Modern
OSMOSE
MAPPING AND
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Give your people the proper records with which to operate! Osmose crews will Map and Number each pole with metal numbers and make out Pole Record Cards of each pole for a charge SO SMALL. Write for details.

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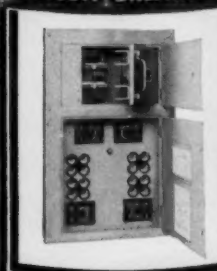
WADSWORTH
LEADS THE WAY
IN
SERVICE EQUIPMENT
100 AND 200
AMPERE IN BOTH
FUSIBLE
AND
CIRCUIT BREAKERS



200 AMPERE
FUSIBLE MAINS
FOR RANGE—DRYER—WATER HEATERS
HEATING PANELS—AIR CONDITIONERS
The WADSWORTH Electric
MFG. CO. INC.
COVINGTON, KENTUCKY.
WRITE FOR NEW FREE CATALOG

washings. Additional washing, however, is required in these areas after having a strong northeast wind for several days.

Conclusions

Our experience indicates that there are four general ways of controlling the effects of contamination:

1. By over-insulating to the extent of providing from 2″ to 3″ of leakage distance per kv, and by bonding all exposed hardware to ground.

2. By the removal and replacement of contaminated insulators with clean insulators.

3. By the use of a suitable protective coating, to increase the surface tension on insulator surfaces, and to prevent bonding action between the contaminent and the insulator.

4. By periodic washing with water under high pressure.

In our area, we have found a combination of these various methods to be desirable. In general, over-insulation, together with the use of periodic washing with high pressure water, has provided us with our most effective method. Increased use of protective coatings in the future will, no doubt, play a more important role in our efforts to control contamination.

Sudden-gas-pressure

(Continued from page 47)

rates of rise of 10 to 15 psi per sec cause the relay to operate in 2 or 3 cycles, and for rates of 40 psi per sec it will operate in ½ second, indicating the inverse time-function of the device. It will not operate, however, on changes in pressure common to normal transformer operation. Disturbances external to the transformer whether mechanical or electrical will not trip the relay unless the transformer is damaged itself.

What this really means to transformer protection can best be described by reference to the accompanying illustration. Although this is a calculated curve, it has been checked favorably against tests in which arcs were produced under oil.*

The completion of the SPR relay has given utilities and industry a new protective device which will sound an alarm and/or trip selected breakers upon occurrence of a fault inside the transformer. Compared with other pressure devices, it is much more sensitive to small faults, less sensitive to inherent static pressures, and much quicker to operate when a major fault occurs.

Vector diagrams

(Continued from page 60)

angle becomes less than 90° and the cosine is positive.

By way of further analysis, we note that the voltage vector E_{yz} is lagging its corresponding current vector I_a by 90° at unity power factor; at unity power factor the varmeter reading is zero since the cosine of 90° is zero; when I_a lags its present position the angle becomes less than 90°, the cosine has a positive numerical value and the varmeter reads upscale. This shows that vars are flowing "out" to an inductive load. When I_a leads its present position the angle between it and the vector E_{yz} becomes greater than 90° and the cosine becomes negative and the varmeter reads down scale. This shows that vars are coming "in" from a capacitive load.

Turning to Fig. 17, we note that the two-element varmeter is not as obvious as the foregoing, but the same basic principle applies, that is the voltage must be shifted 90° backward from the angular position required for a wattmeter.

The usual method of obtaining the necessary shift is by the use of two auxiliary potential transformers with tapped secondaries connected open delta, or one tapped auto transformer similarly connected. The latter is the more common, but the former is used in the illustration as it seems to be preferable for purposes of analysis.

The upper vector diagram of Fig. 17 shows at a glance the two voltages, V_{wx} and V_{yz}, that are 90° out of phase with the wattmeter voltages, E_{ab} and E_{cb}. By moving these voltages parallel with themselves to the open vector diagram below, and letting one end coincide with the origin, it becomes apparent just what positions represent voltages 90° backward from the wattmeter voltages.

Recalling the significance given the arrowheads and voltage notations of Fig. 15, we apply the same reasoning to Fig. 17 and see that the voltage for replacing E_{cb} is V_{yz} and that the voltage for replacing E_{ab} is V_{wx}.

As a further aid in ascertaining the correct direction from the vector diagram, the following two steps are suggested:

(1) While noting that V_{yz} is dis-

placed 90° from E_{cb}, note that the point, y, also lies on another voltage vector which is known to lag the vector E_{ab}; therefore the terminal, y, must be the polarity terminal for replacing the terminal c in making the varmeter connections.

(2) While noting that V_{wx} is displaced 90° from E_{ab}, note that the point, X, also lies on another voltage vector that is known to lead the vector E_{ab}; therefore the terminal, x, if used to replace the terminal, a, would result in a voltage that leads the voltage E_{ab}; since a voltage that lags E_{ab} is required the terminal, w, must replace the terminal, a, in making the connections.

In the foregoing cross connections, the correct voltage quantities were obtained by adding enough turns to the auxiliary potential transformer secondaries to produce quadrature voltages equal to the potential transformer secondary voltages. The additional turns are represented by a-y and c-x on the upper vector diagram of Fig. 17. This vector diagram may serve also as the development of the winding of a phase shifting auto transformer to be used in lieu of the two 2-winding auxiliary potential transformers.

Totalizing meter

(Continued from page 46)

circuits is less than the arithmetical sum of the kva of each of the circuits. It is, however, the true totalized kva of the two circuits when considering the characteristics of the total power supplied.

Method No. 2 — Paralleling Secondaries of C.T.s. (See Fig. 2.) This method is limited to circuits that are paralleled, or to circuits that are fed from a common bus or source of supply. The number and types of meters required for this method will depend upon whether a type RI meter or a type WRI meter is used. The cost of this method is less when using the type RI meter than when using the type WRI impulse meter.

Several sets of current transformer secondaries may be paralleled and connected to the current coils of a type RI meter, thereby eliminating the necessity of the contact-equipped meters on each circuit as required when the type WRI meter is used.

Method No. 3 — Multi-element meters. (See Fig. 4.) This method is perhaps simpler and more flexible in application than either of the preceeding methods. The type RI-32 meter for 3-wire, 3-phase circuits and the type RI-38 meter for 4-wire, 3-phase circuits are suitable for totalization of kva irrespective of paralleling or the power factors of the circuits.

The totalized kva loads of circuits with power factors varying from leading to lagging may be accurately obtained by use of the type RI-32 meter, and the type RI-38 meter. In each of these meters the rkva elements exert torque on a common shaft causing the meter disc to rotate in a direction and at a speed proportional to the resultant of these torques. Through the unique differential gearing of the meter register, a correct kva registration is obtained regardless of the direction of rotation of the meter discs. With this type of metering, the totalized loads are obtained but the individual load of each bank is not obtainable from the meter.

Totalized metering of permanently paralleled circuits is relatively simple compared to that of intermittently paralleled circuits. Multiple sets of potential transformers are usually required on intermittently paralleled installations to insure metering voltage whenever any of the circuits are de-energized.

It should be noted that where transformer banks are intermittently paralleled the timing element of the demand meter must remain energized at all times, regardless of which bank may be de-energized. This may be accomplished by use of a throw-over relay for swapping the timing motor circuit to an energized circuit in case its normal source of supply is interrupted.

When planning your next totalization installation remember that what was ideal for the last installation may not be applicable to the next. A hastily selected metering method may be not only the most costly installation but one that fails to accurately indicate the metered data desired. Careful planning and the application of metering knowledge on each totalizing installation will result in accuracy and economy, a worthy goal in any enterprise.

for the
LONG PULL
use
Y-ER EAS
Wire Pulling Lubricant
Only Y-ER EAS has all these features
Write for descriptive booklet
• Creamy, non-corrosive lubricant. Never greasy or messy.
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• Does not run back on cables.
• Never harmful to hands or clothing.
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GIVES THE SLIP TO-
Lead, Rubber, Braid or
Synthetic Covered Cables
AT ALL LEADING ELECTRICAL SUPPLY HOUSES
ELECTRO COMPOUND CO.
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Electrical controls

(Continued from page 29)

eration of her machine and will not tolerate an interruption or breakdown. Any noon gathering of employees around the electrical counter is proof enough of what the equipment means to them.

Each of the 215 employee positions per shift at the tables is represented on the electrical counting board. With two shifts per day during season from September to January, the performance of 430 persons is recorded appearing in four and six-digit windows under categories listed as Line 1, Line 2, Line 3, etc., indicating trimmers, slicers, etc.

After an apple has been trimmed (removing the defects), it is dropped down a saw chute, and in dropping the apple trips a lever and is thus registered on the counter board electrically. The lever is tripped by micro-switch. A problem was anticipated here of weight of fruit. With variations from one season's crop to another in size and weight of each apple, the problem of sticking in the chute, getting a double count or no count at all caused constant supervision of the chutes and counter during the first year. A season of lightweight apples was particularly troublesome. A proper balance in the lever arm itself was worked out through counterweight by welding a flipper onto the arm.

The spattering and seeping of fruit juice onto electrical equipment is always present in a processing plant. Moisture from the product and washing down after each day's work wets the micro-switches and puts them out of order. While an inexpensive item, micro-switches are being continually repaired and replaced, and in the future may be eliminated and substituted with an electric eye now under consideration. But the problem is presently with us.

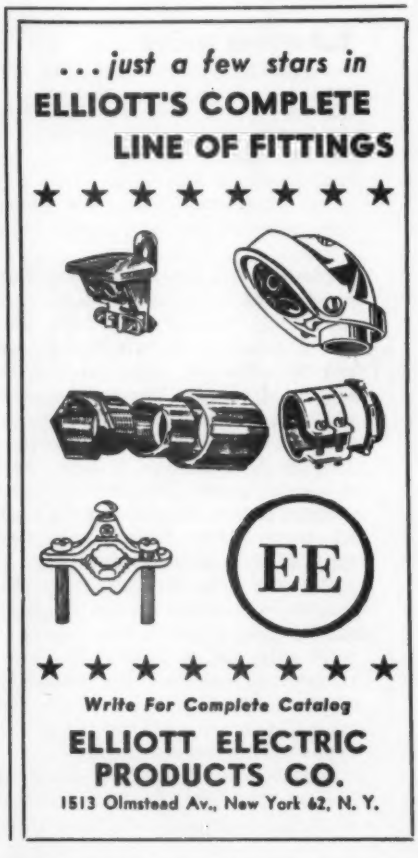
Fruit acid attacking non-corrosive metals required us to paint with a protecting coating all pulleys, metal housings and metal surfaces on machinery subject to damage. All worktable tops are stainless steel.

Our maintenance crew of three mechanics and two oilers per shift sees that all moving parts on machines get daily lubrication. They are constantly on the lookout for trouble for it is very vital to our type of operation that no breakdown occur during season. Our most frequent repair is the breaking of core knives and peeling knives which are replaced with new blades. Belts are often repaired and given new lacing.

As a rule, a temporary repair made during the week to avoid interruption of machine operation is given full repair on Saturday, at which time all machines and electrical parts are lubricated. The counter is checked every Saturday and switches inspected at each position. During the summer months prior to the reopening of the plant's fruit processing season all wiring and motors are gone over and repaired.

While a program of preventive maintenance has kept electrical trouble to a minimum, we have available the services of an electrician in the event of a breakdown that would cause disruption of operation. Electrical problems in a fruit processing plant are far from routine, each season's crop presenting a new set of unpredictable conditions.

Increased production since '53 when the incentive pay plan was introduced necessitated adding digits to some of the four-figure windows on the electrical counter.



Anticipating further production increases, we allowed space on the counter for the addition of windows.

At present we are planning the placement of additional wiring on the electrical counter to take care of expansion brought about by the incentive pay plan.

Code discussion

(Continued from page 42)

more than one multi-wire branch circuit is carried through a single raceway the ungrounded conductors of the additional circuit may be colors of other than those specified. All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation." It is not the last sentence that causes confusion, but the one before it and when taken together.

We have, for example, a 24-circuit, 3-phase panel. With 18 of the circuits connected, we have 6 black wires connected to phase "A" feeder conductor, 6 red wires connected to phase "B" feeder conductor, 6 blue wires to phase "C" feeder conductor, and 6 white wires to the neutral bus. Now we have to drag in two 4-wire circuits through the same raceway which will complete the 24 circuits.

Of course, we will use our regular black, red, and blue colors for one of these multi-wire circuits. The mere fact that we do not use these same colors for the other circuit also does not indicate, necessarily, that we are too stupid to take one of each color one way and the remaining ones the other way. Nor is it because we do not have a notch-cutting attachment on our pocket knives or tape with which to put temporary markers on the wires. We want the extra colors for permanent identification inside of a machine, say, where both circuits terminate.

The Code permits us to do this provided that we again connect all of the wires of the same color to the same feeder. Although not required to do so, it might be better in a case such as this to match the new colors with the old on the same feeder. For instance, to the phase where red wires are already connected, could now be connected the new shocking pink or maybe orange. For the phase with blue, add purple. Remember, the matching is a suggestion only, not a requirement. Avoid using aquamarine—it resembles green. Actually, the new wires could be painted black, red, and blue at the panel.

Other than in these very rare instances, however, there should be exactly as many colors as there are phases plus white for neutrals and green or bare for equipment grounding.

Next month we will discuss the intended method of computing branch circuits and possibly get into feeders.

Answers to test questions: (1. **T** section 2113) (2. **F** 2113) (3. **T** 2113) (4. **F** 2113) (5. **F** 2113) (6. **C** 2113 and 4237) (7. **C** 2114) (8. **A** 2116-a-1) (9. **C** 2116-a-1) (10. **B** 2116-a-1)

High-frequency power

(Continued from page 27)

significant are that efficiency of fluorescent lamps rises appreciably as frequency is increased and that at high frequencies the bulk, weight, and losses of ballasts can be drastically reduced.

For example, at 1500 cycles the efficiency of a 40-watt rapid start fluorescent lamp is 7 per cent above its 60-cycle value, while ballasts are reduced from a four pound, 42-cubic inch mass having 16 watts loss to a simple device weighing about seven ounces, occupying about six cubic inches, and having approximately 4 watts loss.

Accordingly, for a given level of illumination, a high-frequency system requires less power input, heat dissipated in the ballasts is reduced, and less overhead space and ceiling structure is necessary to house and support the luminaires. A promising implication is that changing the geometry of ballasts will free luminaire designers from certain mechanical and thermal problems that have restricted luminaire design.

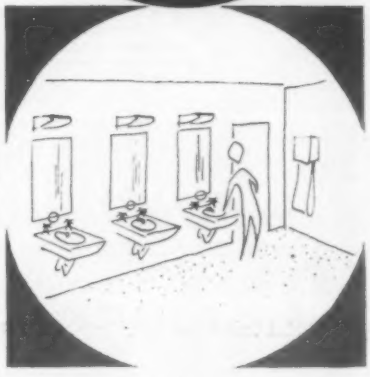
Installation significance

To architects, consulting engineers, and building management, packaged, transistorized high-frequency systems will be significant in several ways. Of major importance is the high reliability afforded by semiconductor devices and the fact that frequency converter units can be installed very near to the lighting load without long high-frequency distribution runs.

Unlike other types of frequency conversion equipment, a vault to house the equipment is not necessary, thus conserving valuable floor space. Also important is their

new

lighting design by mc Philben



mcPhilben's new 37-60 line designed by E. Allan Rothman provides the most efficient lighting of fitting rooms, mirrors, stair landings, telephone bookstands . . . wherever localized illumination is desirable.

Available in both fluorescent and incandescent models offering these exclusive features: continuously hinged doors for easy relamping . . . all metal construction . . . baked on grey enamel finish . . . removable reflectors for easy access to electrical components.

37-60 Two 60 watt lamps
37-65 Two 15 watt T-8 fluorescent lamps

Contact your mcPhilben representative for full details. See our insert in Sweet's file 32a/mc or write for data sheet C/27

mc Philben
LIGHTING COMPANY
1329 Willoughby Avenue, Brooklyn 37, New York

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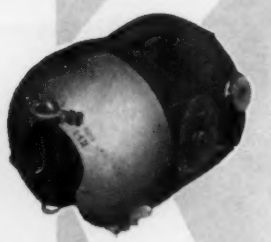

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suitability for small or large scale installation wherever desired, in either a new or old structure; their high reliability and negligible maintenance requirements; their silent operation; and their ability to operate at more than 90 per cent efficiency over most of their load range.

Estimator's methods

(Continued from page 32)

Permit and inspection fees—$700	
Total prime cost	**$13,605.16**
10 per cent overhead	**1,360.51**
Total net cost	**14,965.67**
10 per cent profit	**1,496.00**
Estimate	**$15,461.67**

Having read the book of specifications and digested symbol legends on plans and made notes of any special directions; the type and catalog numbers of devices; types of wire and other pertinent data, the neophyte estimator lists on summary sheets every item shown on his legend sheets, like duplex receptacles, ceiling outlets, motor controls, etc. Using a counter and colored pencil, he takes off and lists all items in order as shown on the plans.

Similarly Turner makes a count of all the devices, listing them on the summary sheets.

Conduit and EMT are taken off in the same manner, with runs listed on the plans checked for length with a rotometer, then Turner follows by taking off the 2-wire conduit runs in the slab and the 2-wire EMT in the ceiling. Their lineal footage is listed, then in order follows the count of: 3-wire conduit and EMT, 4-wire conduit and EMT, 6-wire conduit and EMT, the number of wires designating the size of the conduit.

Having determined the lineal feet of conduit and EMT, Lyman adds the 2-wire runs. (Example) where the length of a run is 3,000 feet, for 2 wires this is 6,000 feet. "To the total footage of wire we add 15 per cent for outlet make-up to get the total amount of wire," said the estimator. From this he goes on to count and list the various fixtures.

Having transferred all the items from the summary sheet to the pricing sheets, along with the quantities of each item, prices are extended, along with the labor units for each item. Following conventional estimating practice, all service materials, panels, switches, and labor units are similarly listed, priced and price-extended, along with labor units. Then quotations are invited from suppliers, mainly on fixtures and panels.

"On big jobs, we get price quotations from 6 to 10 supply houses," said Turner, "while on the smaller jobs, quotes from three suppliers usually suffice. We'll take the lowest quotes on panels and fixtures. On other materials we use the book price."

Pricing sheets are then transferred to recapitulation sheets for totalizing.

Turner's thinking reflects that of Doyle's. Both men assert that what is of more importance than stockpiling expensive power tools is to have them cared for by the superintendent on the job—and a continuing policy of trading them in as fast as more productive tools reach the market.

Electric band oven

(Continued from page 34)

is so simply constructed and automatically controlled that even the most inexperienced operator has no trouble with its operation.

The new oven replaced two gas fired ovens of the pan type, one 84 foot and the other 76 foot. This change resulted in a 20 per cent savings in combined gas and electric utility bills.

Other advantages were the elimination of flues, cooler working conditions and reduction of insurance rates.

The new oven bakes cookies at the rate of 2,000 lbs. per hour or 160,000 cookies per hour. The finished product has a much better color and more of the cookie flavor is retained than before. Because of the close temperature control, shrinkage has been greatly reduced and a uniform baking is consistently obtained. As Mr. Maurice Knox, sales manager, stated, "The real proof of the pudding came when the customers commented voluntarily on the improved appearance and the better quality of the products."

Dallas Auditorium

(Continued from page 25)

vides 6 rows of preset controllers for each of the 44 dimmer units, making it possible to set up lighting control for 6 scenes at a time.

The other control structure provides a row of rehearsal controllers to determine the controller settings for each scene so that these

scenes may be set up quickly on the preset panel for actual performances. On this panel is also installed a scene master controller associated with each of the six rows of present controllers, a fader controller for fading in one scene while fading out another scene, a master controller for controlling any scenes connected to it, a switch for controlling each constant circuit relay, a clock, partial and complete blackout switches, control switches for energizing control transformers and board lighting, push buttons for energizing stage sound effect bells and buzzers in theatre foyer and dressing room areas, and a switch to control the motor operated house lighting dimmer.

A theatre house telephone outlet is also provided with a telephone headset for the board operator. The console control circuits operate on low voltage and plug-in type control cables connect the console to the patch cabinet. Handles of controllers and dimmer connection plugs on the patch panel are color coded to indicate which rating of dimmer is being connected and/or controlled.

Long and short cables between the console and patch cabinet make it possible to operate the console at any location along one side of the stage or on the orchestra lift stage at any of its various elevations. The appearance and ease of operation are the best known at this time, with maintenance and adjustments cut to a minimum after field adjustments were completed.

Lighting power and control

Two sources of power are used for lighting the project, one being the normal lighting supply and the other being the emergency lighting supply. The normal lighting supply is taken from power received through the seven switchgear feeders, and the emergency lighting supply is taken from a tap off the power supply to the project ahead of the switchgear main breaker. Lighting power is from 120 volt branch circuits except for 480 volt circuits used to energize parking lot luminaires and certain outdoor signs.

Most of the lights in large rooms and concourses are controlled from the lighting panels, whereas, lights are switched locally for small rooms, except that emergency lights in small rooms are controlled at lighting panels and lights in the arena auditorium are controlled from special remote control panels.

Emergency lighting system lighting fixtures are energized from four lighting panels. They include strategically placed night lights in exhibit areas, concourses, corridors, and in public toilets, where these fixtures furnish a part of the normal light requirements for these areas and rooms.

Emergency lighting power also energizes step lights and aisle lights in the arena and theatre auditoriums, and exit lights throughout the project. All emergency circuits are controlled from lighting panels.

Concourse lighting

Lighting of concourse areas surrounding the arena auditorium is by radially placed rows of recessed fluorescent lighting fixtures and approximately 2000 feet of cove around the arena wall. Ramps connecting to the concourse areas are illuminated by incandescent lamp lighting fixtures.

Lighting intensity in the concourse areas is approximately 30 footcandles to attract the public at night and to reduce the contrast between indoors and outdoors during the day since clear glass walls separate the concourses from the out-of-doors.

Arena exterior lighting

A canopy at third floor ceiling level encircles the exterior of the arena building. Pedestrian traffic space below this canopy is lighted by recessed incandescent lamp fixtures and 64 flood lights mounted above the canopy bathe the upper part of the cylindrical wall with light, which attracts attention to the building for considerable distance in all directions. Six 60 foot flag poles in front of the arena main entrance are also floodlighted.

Parking lot lighting

Parking lot lighting is provided by 1000 watt color corrected mercury vapor lamps installed in street lighting type luminairs pole mounted approximately 30 feet above the pavement, resulting in an average lighting intensity of 1.5 footcandles.

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in the bases of the steel poles, and are energized by three 480 volt circuits installed underground in conduit. These circuits are connected through a contactor controlled by a timer switch.

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3—General electric single phase transformers—Type HS, 60 cycle, 33000V PRI 485V—sec. with 5—2½% taps, 5.2% impedance at 75°C, 400 KVA, 55°C rise, subtractive polarity, serial Nos. 7527469, 7527470, 7527471. Reply to: Box 731, **ELECTRICAL SOUTH**, 806 Peachtree St., N. E., Atlanta 8, Georgia.

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Power supply

The power supply comes from three 1,000 kva transformers installed in the power vault by the power company. These transformers are normally fed by a 13kv underground feeder, but if this power fails the transformers can be energized by a second underground feeder of the same voltage.

A 4,000 ampere bus duct connects the 3-phase, 480 volt power supply from the transformers in the vault to the main switchgear in the main mechanical equipment room of the arena building.

Switchgear

The main switchgear includes metering of voltage, amperage and wattage, an emergency feeder ahead of the main breaker, and seven feeder breakers behind the main breaker. The main and feeder breakers are electrically operated air circuit breakers controlled by control switches mounted on the switchgear.

The emergency power supply is controlled by a manually operated air circuit breaker protected by high capacity fuses, and breaks up into three feeders to remotely located transformers.

Power distribution system

The seven feeders from the main switchgear connect to main power distribution panels in electrical equipment rooms located in various parts of the arena and theatre buildings, and to two motor control centers located in the same room as the main switchgear. The main power distribution panel in the upper ring and the motor control centers are fed by 1200 ampere bus ducts.

The other main power distribution panels are fed by cables in conduit, and have capacities of 225 to 1200 amperes each. These main power distribution panels and motor control centers sub-feed sixteen 480 volt, three-phase power panels which feed 22 dry type transformers having a capacity of 2417.5 kva and 480 volt motors. These transformers feed seventeen 120/208 volt secondary power panels, 59 lighting panels, and eight power disconnect switches.

Most of the lighting panels are fed from the secondary power panels, but several transformers feed 120/240 volt, single-phase lighting panels direct for service to emergency lighting circuits and to 240 volt convenience outlet receptacles in exhibit areas. The disconnect switches feed temporary stage lighting and television power and lighting circuits and motion picture projection equipment.

Power use

The power distribution system supplies 480 volt, 3-phase power to 131 motors, and 120 and/or 208 volt power to 60 single phase motors, totaling more than 1200 horsepower. It also supplies power to 1550 lighting panel branch circuits, seventeen 480 volt, 3-phase receptacles, 480 volt lighting circuits for the parking lot and power for television and motion picture equipment and auxiliary lighting associated with them.

Lighting panel branch circuits energize 1450 convenience outlet receptacles and 6900 lighting fixtures, with 893 of these convenience outlet receptacles being installed in the principal exhibit areas.

Convenience outlet receptacles in exhibit areas include 640 wall outlets for single phase 120 volt service, 206 floor outlets for single phase 120 volt service, 17 wall outlets for three-phase 120/208 volt service, 30 wall outlets for single phase 240 volt service and the 480 volt three phase receptacles mentioned above.

Power control

Air conditioning equipment installed in the arena building is controlled from an engineer's control panel in the main mechanical equipment room of the arena building and an engineer's control panel in the main mechanical equipment room of the theatre building performs the same function for air conditioning equipment installed in that building.

Flow meters on these panels indicate the flow of chilled water and condenser water, and pneumatic switches associated with these meters are interlocked with the control circuits of various items. Push button control stations permit remote control of the operation of all air handling units, air recirculating fans, chilled water pumps, condenser water pumps, hot water pumps, condensate pumps and cooling tower fans.

Most of the exhaust fans and air supply and relief fans are interlocked with the air handling units to maintain the proper balance of pressures in the various rooms and areas. The remainder of the exhaust fans are individually controlled for use in ventilating concession areas, mechanical rooms and toilet rooms.

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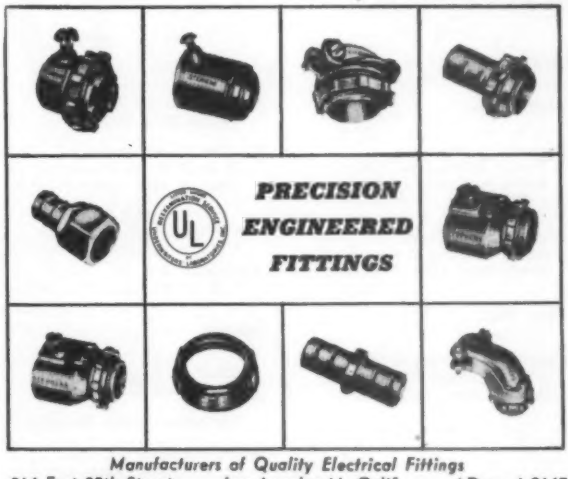

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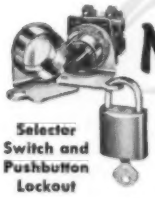
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Variety of contacts • Contact block arrangements include single-pole double-circuit, duplex double-circuit, tandem duplex, three-position duplex, and overlapping contacts.

• • •

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There's a BUSS Fuse or FUSETRON Fuse to fit the needs of every user

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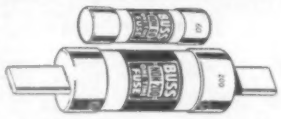


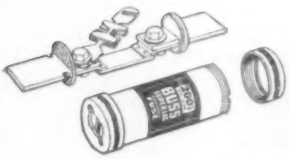
They save you time and trouble because they get the same engineering care in manufacture as do all products carrying the BUSS Trademark.

Every BUSS One-Time fuse can be depended upon to operate as intended under all service conditions.

If you want Renewable Fuses . . .

Use BUSS Super-Lag Renewable Fuses

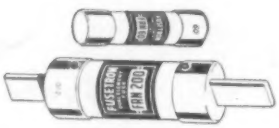
The big advantage of these fuses over all other renewable fuses comes from the prevention of useless interruptions of service caused by needless blows.



The reason for this performance is found in the design of the fuse-case which assures good contact on the fuse link, even if the fuse is renewed by an inexperienced person—and by the time-lag built into the link that prevents the fuse from opening on motor starting currents or other harmless overloads.

If you want fuses that — abolish all needless blows, stop overheating in panels and switches, protect motors against burnout . . .

Use FUSETRON dual-element Fuses



With rare exceptions, ordinary fuses or circuit breakers do not protect except against short-circuit but FUSETRON fuses provide TEN POINT protection.

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating—lesser resistance results in much cooler operation.
4. Provide thermal protection—for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors—without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money—permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

FUSETRON dual-element FUSES save everybody time and money because they are made to PROTECT—not to blow.

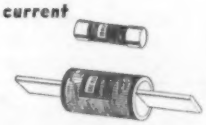
If you want SAFE protection on loads above 600 and up to 5000 amps . . .

Use BUSS Hi-Cap Fuses

On voltages up to 600, high speed operation on heavy shorts limits current to safe values. This minimizes damage to equipment and cuts down dangerous stresses on transformers.

For Short-Circuit Protection where fast opening is required to limit the let-thru current

Use BUSS Limitron Fuses



The extremely fast opening characteristics of these fuses prevent heavy short-circuit currents from building up under fault conditions.

If you want Plug Fuses . . .

Use BUSS Clear Window Plug Fuses

Their one-piece body and "safety" design guarantees protection.

They are most convenient to use too, because real big window and white backgrounds permits entire fuse strip to be seen. Even in poor light a blown BUSS fuse is easy to find.

If you want to reduce blowing of plug fuses . . .

Use FUSETRON dual-element Plug Fuses

FUSETRON Plug fuses protect like ordinary fuses against short-circuits and overloads—but unlike ordinary fuses they won't blow on motor starting currents or other harmless overloads.

They are the type of fuses recommended in the 1953 National Electrical Code.

If you want to make safe protection REMAIN SAFE as well as REDUCE blowing of fuses . . .

Use BUSS Fustats (have Type S base)

FUSTATS like Fusetron Fuses have a dual-element and therefore, stop needless blowing —and they do more.

They have a type S base that prevents anyone from replacing them with a penny or substitute—or using a size too large to protect.

FUSTATS fit standard plug fuse holders by means of an inexpensive adapter that locks in place and needs never be replaced.

To protect motors and apparatus of voltages up to 125 against burnout . . .

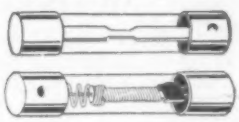
Use 0 to 14 ampere BUSS Fustats

A FUSTAT of the proper size installed to handle only the motor current will reduce to a minimum the chance of a motor burnout from any excessive over-current. In like manner it will protect solenoids, coils or transformers against burnout.

FUSTATS have the same degree of Underwriter's approval for both motor-running and short-circuit protection as the most expensive devices made. They give all the protection it is possible to obtain with any device on the market.

For protection of TV, Radio, Instruments Radar, Avionics and Electronic Equipment . . .

Use BUSS and FUSETRON Small Dimension Fuses



A complete line is available. Made in Dual-element (slow-blowing), Renewable and One-Time types in sizes from 1/500 ampere up.

And there is a companion line of BUSS Fuse Clips, Fuse Blocks and Fuse Holders to take them.

Electrical Equipment is Safeguarded Best...When Individually Protected by BUSS Fuses or Fusetron Fuses.

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

BUSSMANN MFG. DIVISION, McGRAW-EDISON CO.
UNIVERSITY AT JEFFERSON ST. LOUIS 7, MO.